

Is Full Employment Sustainable?

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1. Introduction

The US economy entered a recession in February 2020. This recession follows the longest expansion on record, starting in June 2009 and lasting for 128 months. The end of this recession is associated to the global pandemic caused by COVID-19. The global pandemic came at a time when the US was enjoying very low levels of unemployment. During the last expansion, unemployment kept slowly coming down from a peak of 10% in October 2009 to 3.5% in February 2020.

The low levels of unemployment in the last year of the expansion were seen as delivering gains in segments of the labor market where progress was thought to be almost impossible, bringing some marginal workers from out of the labor force back into employment. During the years 2009 to 2020, as unemployment declined to historically low levels, there was an ongoing debate on whether the US had already reached full employment. This question was relevant to understand both potential output as well as inflationary risks. As time passed, a combination of further reductions of unemployment and increases in the labor force participation, without inflationary pressures, led to upward revisions of what was considered a sustainable level of the employment to population ratio. Unemployment went below previous estimates of the natural rate of unemployment, that was also being revised downwards as time passed.

What is interesting, and a focus of this paper, is that despite the length of the expansion, the potential gains from this high-pressure labor market turned out short lived. The expansion ended right at the time when unemployment rates had reached those very low levels. While a global pandemic represents a unique event, the pattern of unemployment we have just described is present in all previous cycles. In this paper we show that US unemployment exhibits a V shape around all recessions. The second part of the V is known: recessions trigger a sudden increase in unemployment. In fact, the moment we observe unemployment climbing up, it is a sign that a recession started (Sahm (2019)). But, the first part of the V is less known or understood. Unemployment is typically declining in the quarters prior to the beginning of a recession. In other words, we do not observe a long period of stable low unemployment rate. It seems that low levels of unemployment or full employment are not sustainable.

There are several hypotheses that can explain the shape of unemployment around recessions. First, unemployment creates the seed of behaviors that are unsustainable and lead to a crisis. As the economy approaches full employment, financial or real imbalances get built and those lead to a recession. The second hypothesis is that we have never seen an expansion that is long enough to witness a long period of full employment. We find

empirical evidence that supports both hypotheses. Imbalances increase as unemployment decreases. And even when they do not, shocks happen (like a global pandemic) ending an expansion that had just brought the labor market to full employment.

This paper is related to several strands of the academic literature. Several papers study the question of whether expansions die of old age. There is limited evidence that as time passes the end of an expansion is more likely; expansions do not seem to die of old age (Rudebusch (2016)). While this is true, the evidence of this paper suggests that as unemployment becomes low and reaches levels around or below what we consider the natural rate of unemployment, a recession tends to happen. In other words, if we measure time as the decreasing path of unemployment during an expansion, it seems that after a certain point the chances of a recession increase very fast.

The fact that unemployment displays such a decreasing trend during an expansion lends support to the idea that the business cycle is asymmetric, recessions can be seen as downward deviations from potential and the expansion phase is the time it takes for the economy to return to potential (Friedman (1993), Dupraz, Nakamura, and Steinsson (2019), Jordà, Schularick, and Taylor (2020), or Fatás and Mihov (2013)). What is new in this paper is that the economy seems to spend very little time close to potential, the episodes of low unemployment are short-lived.

Finally, the results of this paper also cast doubt on the empirical relevance of the concepts of full employment or the natural rate of unemployment. It seems that only if we are lucky and an expansion lasts for many years, as in the expansion starting in 2009, the economy finds itself at lower rates of unemployment. This is linked to a literature that has shown the slow speed at which unemployment decreases during an expansion (Hall and Kudlyak (2020), Cole and Rogerson (1999), Amior and Manning (2018)).

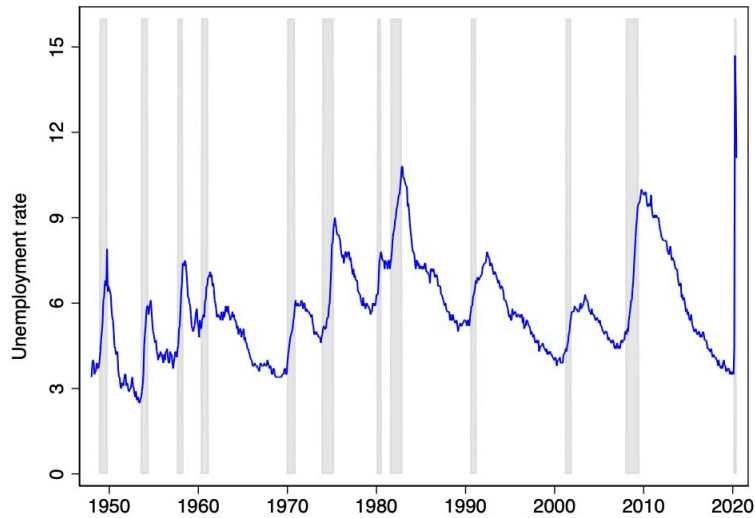
From a policy point of view, finding ways to accelerate the speed of unemployment decreases during an expansion could provide for longer periods of low unemployment. But that needs to be done in a way that avoids the buildup of imbalances via macroprudential policies. Of course, in some cases this might not be feasible, for example when the recession starts as the result of an external shock that happens very early in the expansion phase.

2. Stylized Facts about the Behavior of Unemployment during the Business Cycle

As economy activity declines during a recession, unemployment increases. Once the trough is reached and the expansion starts, we observe a declining unemployment rate towards a low level, typically associated to its natural rate.¹

¹ There is, of course, uncertainty about the level of the natural rate of unemployment. It is not uncommon for this rate to be revised downwards as unemployment falls, as it was the case in the current US expansion.

Figure 1. Unemployment rate



The asymmetric nature of unemployment changes in the two phases of the business cycle is clearly visible in

Figure 1 and is well known in the literature (Neftçi (1984), Dupraz, Nakamura, and Steinsson (2019)). A quick calculation of the average speed of change in unemployment rates during expansions and recessions shows that the speed of unemployment increases in recessions is 10 times faster than the decrease during expansions (Table 1).

Table 1. Absolute average change in unemployment

	Full Sample	Post-1982M12
Recessions	0.304	0.384
Expansions	0.041	0.034

Given that after every cycle unemployment tends to return to similar low levels and given that the speed of change is so different between recessions and expansions, it implies that the duration of the two phases has to be very different. That is the case as expansions are much longer than recessions (Table 2). A phenomenon that has become more pronounced after 1982, a period that was labelled as the Great Moderation.

Table 2. Length of expansions and recessions (in months)

	Full Sample	Post-1982M12
Recessions	10.5	9.5
Expansions	66.6	103.2

Yet another way to describe the different behavior of unemployment in expansions and recessions is to state that unemployment is more likely to be falling than increasing. If we calculate months where unemployment was increasing relative to three months before, we

can see that they are much less common than episodes of stable or declining unemployment (Table 3).

Table 3. Count of months with increasing unemployment rate

	Full Sample	Post-1982M12
Increasing	295	128
Not Increasing	575	322

Despite the asymmetry in the way unemployment behaves during expansions and recessions, the extended duration of an expansion guarantees that unemployment returns to a level that is quite similar across all cycles. This means that if we measure the amplitude of a phase as the total change in unemployment during the corresponding months, there must be a correlation between the amplitude of expansions and the amplitude of the previous recession. Recessions that raise the unemployment by a larger amount must be followed by expansions that reduce the unemployment by a larger amount as well.

A regression (Table 4) confirms this hypothesis. When we regress amplitude of expansions against amplitude of previous recessions, we get a coefficient of about 1 with a high R-squared. A coefficient of 1 suggests that expansions bring back unemployment back to a similar level to the one existing before the previous recessions started.

Table 4. Plucking Model Property

	Amplitude Recovery	Depth Recession
Depth Previous Recession	1.124** (0.384)	
Amplitude Previous Expansion		0.171 (0.315)
Constant	-0.320 (1.160)	-2.626** (1.063)
Observations	11	11
R-squared	0.488	0.032

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Interestingly, this is not true the other way around, the depth of recessions is unrelated to the amplitude of the previous recovery (second column of Table 4). This means that recessions are not likely caused by an excessive decline in unemployment during expansions. Recessions seems to be independent of the previous expansion dynamics.

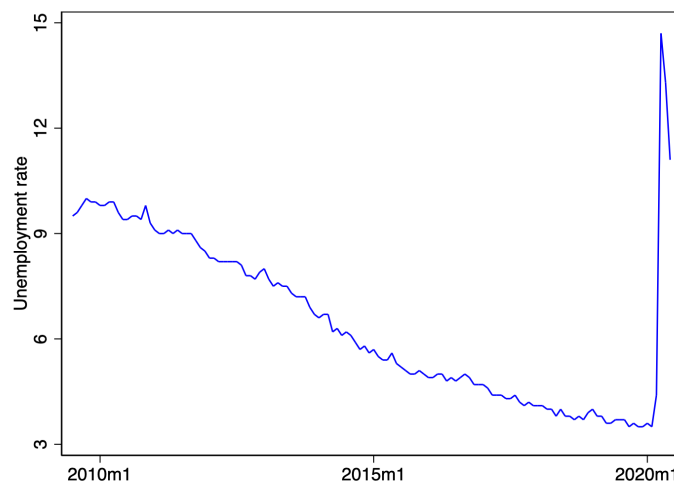
The asymmetry highlighted in Table 1 and the results of Table 4 support the Friedman plucking model of the business cycle (Dupraz, Nakamura, and Steinsson (2019)). Recessions are sudden events that quickly raise the unemployment rate. The economy resembles a

string that has been stretched and moved away from its normal state. Once the expansion starts, we begin the path of reducing unemployment and returning back towards full employment. But it is important to note that from our results above, the return to normal happens at a speed that is slow and that does not depend on the high level of unemployment from which we start or the depth of the previous recession. In other words, and using Friedman (1993) analogy, as the string is stretched it bounces back towards its natural state but the distance at which the string is stretched does not seem to have an implication on the speed at which it bounces back.

There is an additional stylized fact that is not quite part of the plucking model and that the previous literature has not paid enough attention to. As the economy rebounds towards full employment, for how long does it stay close to that natural state? How long until a new shock stretches the economy away from the full employment level?

Let's look at the last expansion that ended in March 2020. Unemployment declined after the recession that started in 2007. It did so for 128 months before it bounced back up with the latest recession.

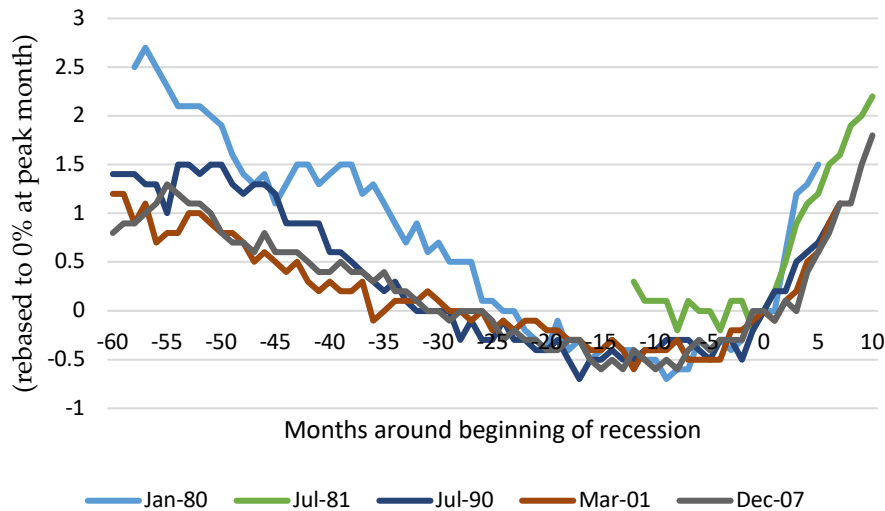
Figure 2. Unemployment Rate in the Last Expansion



Interestingly, the unemployment rate was on a downward trajectory for practically every month during the expansion. Only in the most recent months we find some stability. But there is nothing unique about this expansion, the same pattern applies to every previous US expansion.

Figure 3 displays unemployment rates around the peak of each of the previous five expansions. For easier comparison we calculate unemployment as deviations from the level achieved the month before the recession started (i.e. zero unemployment rate is associated to that month). We plot 5 years before the recession started and 10 months after the recession. Some series are shorter because either the previous expansion was shorter than 5 years or the recession lasted less than 10 months.

Figure 3. Unemployment Rate Around Recessions (US)



All cycles display a V-shape evolution for unemployment. Unemployment declines steadily in each of the expansions and it reaches its lowest point around 12-18 months before the recession starts. In most cases, unemployment was already increasing in the months preceding the recession. What is interesting is the absence of a single long episode of stable low unemployment (or full employment). It seems as if reaching a low level of unemployment is *always* followed by a recession.

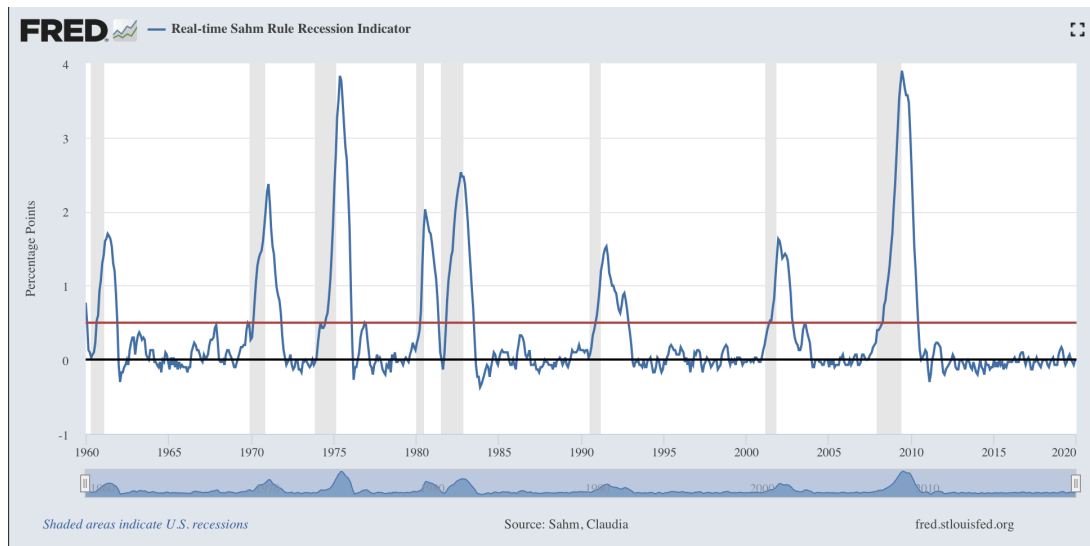
The V-shape that unemployment follows during each of the previous cycles is related to the recently labelled “Sahm rule” to trigger automatic stabilizers in the real time. The Sahm rule that owes the name to Sahm (2019), is based on the observation that once unemployment starts increasing, a recession is following. The rule uses a 3-month average of monthly unemployment rates and then calculated the difference between the current level of that average and the minimum over the previous 12 months. If this difference is larger than 0.5% then the US economy is heading into an imminent recession.

The Sahm rule using real-time data is displayed in Figure 4.² The indicator crosses the red 0.5% threshold before each of the previous recessions. The only times the indicator gives a potential false positive is in Nov 1976 when the index reached exactly 0.5 but a recession had not started or was not about to start for another 3.5 years.

The pattern of Figure 4 suggests that in the US we do not see episodes of increasing unemployment that do not qualify as a recession. In other words, we do not see short-lived episodes of increasing unemployment that get quickly reversed, we do not observe “mini-recessions”.

² Data from <https://fred.stlouisfed.org/graph/?g=qhzx>

Figure 4. Real-Time Sahm Rule Recession Indicator



Our description of the V-shape around recessions goes one step further. Unemployment could follow a wide U shape around before and around recessions and the Sahm rule will still apply. What we are highlighting in this paper is that expansions are periods where unemployment is always declining. Once it stops declining, we are approaching the next recession.

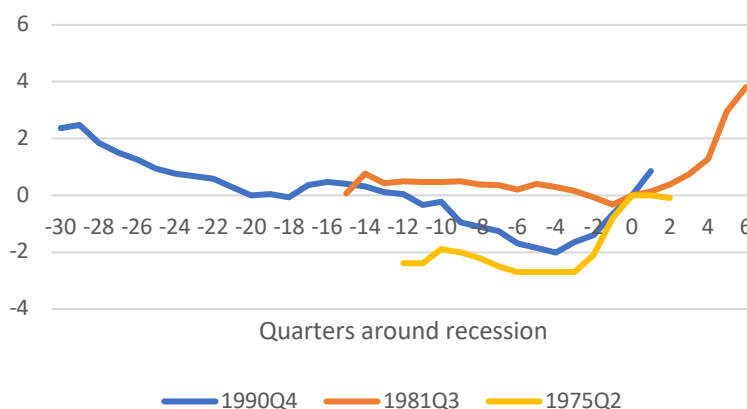
The result might not be surprising if one thinks that once unemployment rate is low, there is only one way for unemployment to go: up. But this is not the right logic as it ignores the possibility of a period of low and stable unemployment. One way to visualize that possibility is to look at other countries. A good example is Australia that has recently sustained a low unemployment rate for decades. After a recession in the early 1990s, unemployment increased and then started a decline through a path similar to any US expansions. By the year 2000 unemployment reached a low level that has remained mostly flat for many years (Figure 5). In other words, the unemployment rate does not display V-shape dynamics but looks more like an open L-shape, waiting for the next recession.

This pattern is indeed common for all cycles in Australia. Figure 6 plots the evolution of unemployment around the three most recent cycles and, in all cases, we see shapes that are different from the V-shape evolution of US unemployment.

Figure 5. Unemployment Rate (Australia)



Figure 6. Unemployment Rate Around Recessions (Australia)

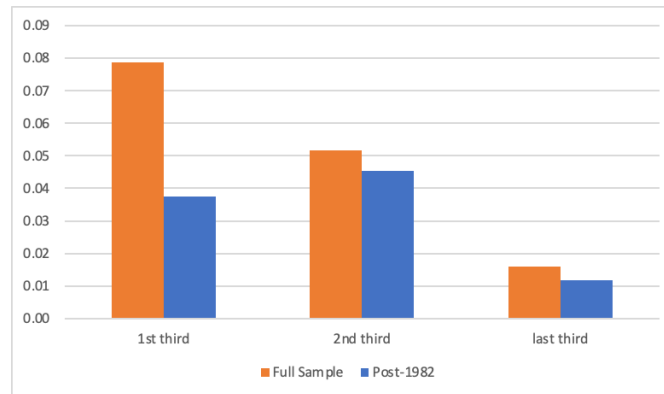


3. The slow march towards low unemployment

In our previous section we have highlighted the difference in speed in the unemployment change between recessions and expansions. We have also seen how expansions are period of declining unemployment and the US has not managed to maintain a long period of stable low unemployment in any of the cycles. A potential hypothesis is that unemployment declines during expansions are too slow and that it takes many years to reach what we can consider full employment. As a result, a recession arrives before a stable period of full employment can be observed.

This hypothesis is consistent with the evidence that reductions in unemployment are slower than what most theories anticipate (Hall and Kudlyak (2020)).

Figure 8. Speed of Expansion Over Time



4. A Quantitative Assessment of Unemployment Risk

One way to formalize our hypothesis is to ask is whether as unemployment decreases there is a significant increase in the probability of a recession. Mechanically, because unemployment rates are mean reverting, we do expect high levels of unemployment to precede decreases in unemployment while lower levels are likely to be observed before a crisis. But how strong is this effect quantitatively? Can low unemployment be seen as a *strong* predictor of recessions? And how does this relationship differ across countries?

As expected, a simple OLS regression using changes in US quarterly unemployment rates reveals that future changes in unemployment are negatively related to the current level of unemployment. Table 6 shows the coefficients of running a regression of changes in unemployment rate over the next 12 quarters (three years) on the initial level of unemployment:

$$(U_{t+12} - U_t) = \alpha + \beta U_t + \varepsilon_t$$

Table 6. Low unemployment as a predictor of increases in unemployment (US)

US	$U_{t+12} - U_t$
U_t	-0.771*** (0.0641)
Constant	4.572*** (0.398)
Observations	242
R-squared	0.376

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The coefficient is negative and significant with a relatively high R-squared.

When we run the same regression for another country (Australia, Table 7) we see also a negative coefficient although smaller in size (and the R-squared is also smaller).

Table 7. Low unemployment as a predictor of increases in unemployment (Australia)

Australia	$U_{t+12} - U_t$
U_t	-0.348*** (0.0445)
Constant	2.322*** (0.288)
Observations	196
R-squared	0.239

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

In the above analysis we are trying to predict any possible future changes of the unemployment rate, large and small, using the current unemployment rate. When we worry about cyclical risk, we typically want to focus on recessionary episodes in which unemployment increases by a large amount at a fast pace. In other words, we want to focus on the tail risk of changes in unemployment, episodes that we call recessions.

Estimating the determinants of the tail risk of unemployment changes is related to the concept of value at risk used by financial institutions: focusing on the worst potential outcomes over a specific time window. The same analysis has been applied to business cycles by focusing on the tail risk of unemployment or GDP growth and we refer to this concept as GDP at risk (Cecchetti (2008), Kiley (2018) Adrian, Boyarchenko, and Giannone (Forthcoming)).

Empirically, we can isolate the effects on a particular part of the distribution by using quantile regressions. Unlike OLS that finds the best fit for the average of the changes in unemployment, quantile regression weights errors differently by putting larger weight on the errors near the quantile of the distribution that is of interest to the researcher. See Koenker and Hallock (2001) for details on the methodology and Kiley (2018) for a similar analysis of unemployment dynamics for the US.

We are interested in the tail risk of sharp unemployment increases, which are associated with recessions, and we will capture that by the 90th percentile coefficient. The question is whether low unemployment rates are followed by large increases in unemployment. We follow Table 8 and show, for the US, the results for three quantiles: the bottom 10%, the average (q50) and the 90th percentile of the distribution (Table 8). While all three coefficients are negative and significant, their size increases as we move from small changes in unemployment to large changes. This means that low unemployment rates are strong predictors of the tail risk of large increases in unemployment.

Table 8. Quantile regression unemployment (US)

Quantiles	Dependent Variable: $U_{t+12} - U_t$		
	q10	q50	q90
U_t	-0.548*** (0.0433)	-0.774*** (0.0934)	-1.062*** (0.149)
Constant	1.651*** (0.245)	4.181*** (0.686)	8.635*** (1.262)
Observations	242	242	242

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Interestingly, the same phenomenon is not present in other countries. Table 9 shows the same results for Australia and the coefficient does not increase in size as we move towards the 90th percentile of the distribution. In fact, the coefficient becomes smaller and it is not-significant for the 90th percentile. This suggests that, unlike in the US, low unemployment rates are not a good predictor of recessionary episodes in Australia (beyond the mean reversion effect present for all quantiles).³

Table 9. Quantile regression unemployment (Australia)

Quantiles	Dependent Variable: $U_{t+12} - U_t$		
	q10	q50	q90
U_t	-0.276*** (0.0201)	-0.412*** (0.0635)	-0.141 (0.141)
Constant	0.397*** (0.131)	2.463*** (0.473)	3.480*** (0.616)
Observations	196	196	196

Standard errors in parentheses

*** p<0.01, **

³ If we apply the same analysis to all other countries for which quarterly unemployment rates is available, we can see both of these patterns. Some resemble the US pattern where the coefficient on unemployment rates increases as we move from the 10th to the 90th percentile (e.g. Greece or Sweden). While in other cases the coefficients are of similar size across the different parts of the distribution (e.g. Germany or the UK).

5. Why is Low Unemployment Unsustainable?

The US pattern of unemployment before recessions suggests that low levels of unemployment as a strong predictor of sudden increases in unemployment, associated to crises. We do not observe in the data any sustained periods of low unemployment (we always see what we call V-Shape unemployment rates). But why is low unemployment unsustainable? What leads to a recession? There is an empirical academic literature (“Growth at Risk”) that analyzes the factors leading to a recession. They tend to emphasize two set of variables: those associated to macroeconomic imbalances (such as inflation) and those associated to financial imbalances. For example, Kiley (2018) studies unemployment risk and uses credit growth, bond spreads and inflation as explanatory variables. Adrian, Boyarchenko, and Giannone (Forthcoming) study GDP growth risk and use the National Financial Conditions Index as their indicator of financial imbalances.⁴

We make use of some of these variables below to see if their introduction in our quantile regression makes the effect of unemployment level change. Once we control for these risks, do we still have low levels of unemployment predicting economic crisis (as captured by sudden and large increases in unemployment)?

We include each of these variables separately in our quantile regression in Table 5. Columns (1) to (3) present the results of including the previous 4 quarter level of inflation.⁵ The coefficient on inflation is positive (as it would be expected) but does not show a particular pattern across the three quantiles we present. The coefficients on the unemployment level are not very different from the ones we had before. We still see that low unemployment rates are significant to explain the tail risks of recessions.

We then introduce the growth of credit over the last 4 quarters.⁶ Results are in columns (4) to (6). Not only the variable is significant, but its coefficient increases as we move from q10 to q90, confirming that fast credit growth tends to precede recessions. But what is more interesting is that the introduction of the credit variable changes the pattern of the coefficients on unemployment levels. Unemployment still displays a negative coefficient, highlighting the reversion to the mean that was apparent in the simple OLS regression, but now the coefficients for the different quantiles are similar. In fact, the q90 coefficient is now smaller than the q50 and similar to the q10 ones. Low levels of unemployment do not seem to be good predictors of the tail risk associated to recessions.

Finally, we present in columns (7) to (9) the results of introducing the National Financial Conditions Index. The coefficient on the index is positive, as expected and there is some increase as we move from q10 to q90, but not consistent as in the credit growth variable.

⁴ Schularick and Taylor (2012)

⁵ Source: Personal Consumption Expenditures: Chain-type Price Index, Index 2012=100, Quarterly, Seasonally Adjusted. <https://fred.stlouisfed.org/series/PCECTPI>

⁶ Source: Total Credit to Private Non-Financial Sector, Adjusted for Breaks, for United States, Percentage of GDP, Quarterly, Not Seasonally Adjusted: <https://fred.stlouisfed.org/series/QUSPAM770A>

When it comes to the unemployment coefficients, they are all higher and we still see a pattern of increasing size as we move from q10 to q90.

Table 10. Unemployment Quantile Regression with Controls (US).

	(1)	(2)	(3)	(4)	(5)	(6)
Quantiles	q10	q50	q90	q10	q50	q90
Unemployment	-0.579*** (0.0462)	-0.908*** (0.0455)	-1.020*** (0.179)	-0.477*** (0.0407)	-0.711*** (0.0662)	-0.529*** (0.172)
Inflation	23.37*** (5.487)	42.21*** (5.666)	29.46*** (9.040)			
Credit				6.842*** (2.031)	10.41** (4.337)	46.18*** (13.78)
Constant	1.342*** (0.293)	3.906*** (0.359)	7.272*** (1.515)	1.176*** (0.247)	3.829*** (0.476)	4.790*** (1.078)
Observations	242	242	242	242	242	242

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11. Unemployment Quantile Regression with Controls (US). (cont.)

	(7)	(8)	(9)
Quantiles	q10	q50	q90
Unemployment	-0.700*** (0.0462)	-0.929*** (0.0796)	-1.286*** (0.120)
NFCI	0.578*** (0.0689)	0.989*** (0.214)	0.856*** (0.261)
Constant	2.966*** (0.329)	5.649*** (0.514)	10.19*** (1.052)
Observations	178	178	178

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results of Table 11 suggest that it is not the low level of unemployment rate that necessarily leads to a recession, but the imbalances that are associated to those low levels. In particular, out of the imbalances we have considered, credit growth seems to have the strongest explanatory power.

6. Discussion (very preliminary)

The result of this note suggests that for the US economy, low unemployment is not sustainable. Expansions are period where the labor market keeps improving but it never reaches a state of stable full employment where we can enjoy the benefits of running a high pressure economy.

There are several hypothesis that can explain this behavior. One of them is that the economy builds imbalances that are the seed of a recession. Our analysis using quantile regressions produces support for this hypothesis.

But this hypothesis cannot be enough to explain all cycles. The current cycle is caused by a global pandemic, not a financial imbalance.

So maybe recessions end in two ways, either because they get old enough to create a large enough imbalance or because we are unlucky and an external shock happens. In either case, we do not see long periods of low unemployment, expansions are not long enough for us to see those episodes or unemployment decreases too slowly in the up to 10 years of an expansion for us to see them. This view of cycles fits well the idea of asymmetric cycles where recessions move the economy away from potential output and expansions take us back there slowly (Fatás and Mihov (2013)). Recessions can then be seen as large or small disasters interrupting the natural growth path of GDP (Jordà, Schularick, and Taylor (2020)).

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