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MACROECONOMIC ADVISERS'

MACRO FOCUS

THE SHAPE OF THINGS TO COME

In this MACRO FOCUS, our resident time series econometrician, James Morley, examines some empirical issues surrounding the possible shape of the current recession and its eventual recovery. His analysis involves i) categorization of different possible shapes based on letters of the alphabet; ii) discussion of correlations between output growth across different phases of the business cycle and Milton Friedman's "plucking model" explanation for these correlations; iii) comparison of simple time series models of output growth; and iv) consideration of the worrisome possibility that "this time will be different." Based on the empirical analysis, the preferred time series model has the characteristic that the strength of economic recovery is closely related to the depth of the preceding recession, implying that the current recession and its recovery should have a "V" shape. This prediction is contrasted with the Macroeconomic Advisers forecast, which corresponds more closely to an "L" shape, at least in the near term.

ALPHABET SOUP

There has been much discussion about the possible "shape" of the current recession that, according to the NBER, began in the last quarter of 2007. Based on past experience and common parlance, the main candidate shapes for the recession and its eventual recovery can be described by three letters of the alphabet: "V", "U", or "L".[1]

A "V"-shaped recession corresponds to the idea that, when the current recession ends, the recovery will be strong and output will return back towards its trend path prior to the recession. As an historical example, in the second through fourth quarters after the 1973-75 recession, the annualized growth rates for U.S. real GDP were 7%, 5%, and 9%, respectively — far above the 3% long-run average. A robust recovery that follows a sharp contraction traces out a "V" shape for the level of output. This pattern can be easily seen in the path of US real GDP around the 1973-75 recession, displayed in the first panel of Figure 1.

A "U"-shaped recession corresponds to the idea that the trough of a recession is less well-defined than in the "V" shape case. There are two proximate causes for a smoother trough. One is that the negative growth rates of a recession become less severe as the recession extends beyond its first few quarters. The other is that the initial recovery following a trough is tentative, with above-average growth rates occurring only a few quarters after the recovery has taken hold. This "U"-shaped pattern can be seen in the path of U.S. real GDP around the 1981-82 recession, displayed in the second panel of Figure 1. Note that, as with the "V"-shaped recession, the fast-growth recovery brings output back towards its trend path prior to the recession.

[1] Extending the alphabetical analogies further, there has even been some recent discussion about a possible "W"-shaped "double-dip" recession. While there is no historical precedent for such a pattern, there have been "twin" recessions that occurred close together (e.g., the 1980 and 1981-82 recessions).

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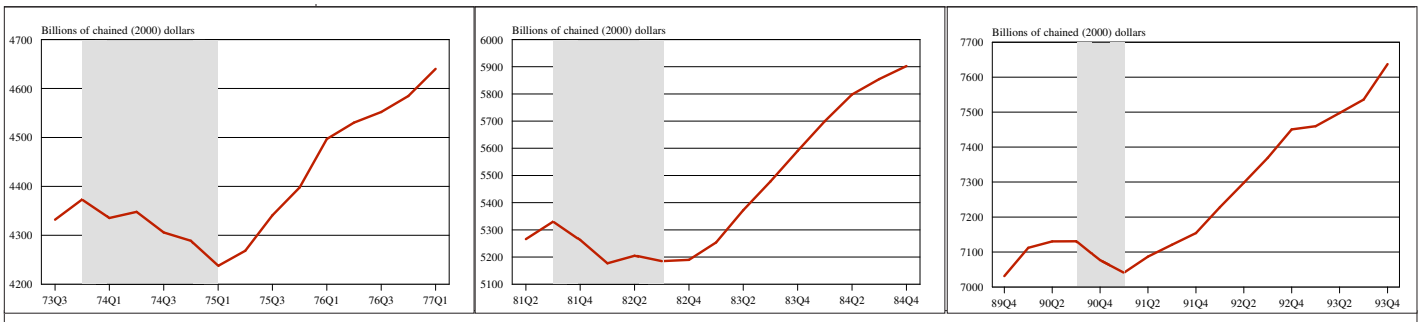
Figure 1
Different Shapes of Past Recessions



Notes: The three panels display U.S. real GDP in the 1973-75, 1981-82, and 1990-91 recessions and their recoveries, respectively. The NBER recession dates are shaded.

In the case of an "L"-shaped recession, there is no subsequent fast-growth recovery. Post-recession growth at normal expansionary rates implies that the economy will eventually return to its pre-recession level of output and continue upward from there. However, an "L"-shaped recession has a permanent effect on the economy in the sense that output is expected to grow along a permanently lower trend path than if the recession had not occurred. Visually, a sharp contraction in output followed by moderate growth only traces out a (tilted) "L" shape. This pattern can be seen in the path of U.S. real GDP around the 1990-91 recession, displayed in the third panel of Figure 1, although the growth speed-up in 1992 means that it is possible to see an elongated "V" or "U" shape if one extends the time frame for recovery long enough.

Business Cycle Correlations and Milton's Metaphor

Which of the letters "V", "U", or "L" will best describe the shape of the current recession and its recovery? To answer this question, it is helpful to begin by looking at historical correlations in the data related to the business cycle.

When considering postwar U.S. business cycles based on NBER peaks and troughs, there are three particularly revealing correlations related to the strength or weakness of output growth in consecutive phases of the business cycle. These correlations are reported in Table 1.

Table 1
Correlations Between Output Growth in Consecutive Phases of Postwar Business Cycles

	sample correlation	z-statistic
Entire expansion, subsequent recession	8%	0.2
Recession, entire subsequent expansion	-19%	-0.6
Recession, subsequent recovery	-68%	-3.8

Note: Output growth is measured using 100 times natural log differences for U.S. real GDP. The sample period is 1947Q2 to 2001Q4 for the first correlation and 1948Q4 to 2007Q4 for the second and third correlations. For the purposes of the correlations reported here, "entire expansion" is defined as trough to peak as identified by the NBER, "recession" as peak to trough, and "recovery" as the first four quarters following a trough.

The first correlation, which is between output growth in an entire "trough-to-peak" expansion and output growth in the subsequent "peak-to-trough" recession, is positive, but small. What does this mean? The positive correlation corresponds to the idea that a strong expansion will be followed by a relatively mild recession (e.g., the 1983-90 expansion and the subsequent 1990-91 recession), while a weak expansion will be followed by a severe recession (e.g., the 1980-81 expansion and the subsequent 1981-82 recession). Of course, the fact that the correlation is small and statistically insignificant means that there may, in fact, be no particular relationship between the strength of a given expansion and severity of the subsequent recession.

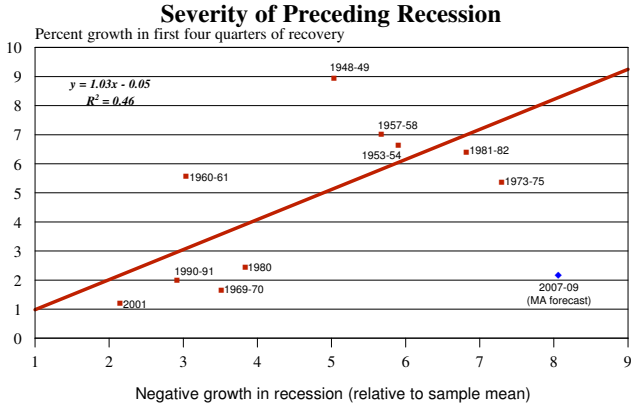
The second correlation, which is between output growth in a recession and output growth in the entire subsequent expansion, is negative and a bit larger in magnitude than the first correlation, although it is still not statistically significant. The negative correlation corresponds to the idea that a severe recession will be followed by a strong expansion (e.g., the 1981-82 recession and the subsequent 1983-90 expansion), while a mild recession will be associated with a relatively weak expansion (e.g., the 2001 recession and the subsequent 2002-2007 expansion).

The idea that the correlation between growth rates in two consecutive phases of the business cycle depends on whether it is for "expansion and subsequent recession" or for "recession and subsequent expansion" was first pointed out by Milton Friedman as long ago as 1964.[2] It is important because it suggests that the phase of the business cycle has forecasting implications above and beyond the particular growth rates that occurred in those phases. By contrast, if "expansion" and "recession" were merely ex post labels for persistent periods of above- or below-average growth, then there would be no reason why the first two correlations reported in Table 1 would depend on the ordering of expansion and recession. For example, suppose there is some inherent momentum in output growth from quarter to quarter, but the phase of the business cycle contains no additional information about future growth beyond being a label for past growth. Then, output growth should display positive serial correlation and both of the first two correlations in Table 1 should be positive. Conversely, suppose there is an inherent tendency for persistent periods of high growth to be predictably offset by persistent periods of low or negative growth and vice versa. Then, output growth should display negative serial correlation and both of the first two correlations in Table 1 should be negative. Thus, the fact that the first correlation is positive (or essentially zero), while the second correlation is negative, suggests that "expansion" and "recession" are more than just labels. Instead, expansions imply little or no serial correlation for output growth in the immediate future, while recessions imply negative serial correlation in the near term.

Milton Friedman interpreted the two correlations and the fact that they are different as evidence of capacity constraints for the whole economy that bind during mature expansions, but not during recessions and their recoveries. Using a somewhat whimsical metaphor, he

[2] Milton Friedman discussed these correlations in Friedman, M., 1964, *Monetary Studies of the National Bureau, the National Bureau Enters Its 45th Year, 44th Annual Report* (NBER, New York), pp. 7-25, reprinted in Friedman, M., 1969, *The Optimum Quantity of Money and Other Essays* (Aldine, Chicago), pp. 261-284. Many years later, he returned to these correlations and his explanation for them in Friedman, M., 1993, "The 'plucking model' of business fluctuations revisited", *Economic Inquiry* 31, pp. 171-177.

Figure 2
Strength of Recovery versus Severity of Preceding Recession



Notes: Points are labeled by recession. The growth in recovery is expressed as a percentage of real GDP at the trough. The negative growth in recession is expressed as a percentage of real GDP at the peak and is adjusted for unconditional mean growth. The fitted line is based on least squares for all of the completed postwar recessions and recoveries, but not the MA forecast of the 2007-09 recession and recovery.

likened the behavior of aggregate output to that of a string attached by two nails to the underside of a long wooden board. The board represents full capacity for production and is tilted slightly upwards to reflect the secular increase in economic activity over time. A recession (which, no doubt, he thought was due to mismanaged monetary policy) corresponds to the pulling or "plucking" of the string below the board. When the force pulling the string down is released (i.e., bad policy is ended), the string "snaps back" to the board. In this way, the strength of an expansion is directly related to the severity of the preceding recession and there is an implied negative correlation between growth in the recession and growth in the subsequent expansion. Meanwhile, the wooden board acts as a ceiling that prevents the string from being pulled upwards. Thus, there is no implied correlation between the strength of expansion and the severity of the subsequent recession.

If the only evidence for Milton Friedman's "plucking model" were the first two correlations in Table 1, then their statistical insignificance would raise serious doubts about the relevance of his whole story. However, the third correlation in Table 1, which captures the relationship between output growth in a recession and the output growth in the subsequent "recovery" period, defined as the first four quarters following a trough, is strongly negative and statistically significant. This is presented visually in Figure 2, which plots the strength of growth in the first four quarters of expansion against the severity of the preceding recession as measured by the short-fall in growth for the economy in the recession relative to long-run average growth. Note that the benchmark of long-run growth means that this measure of severity reflects both the length and depth of a recession.

The plucking model suggests that the strength of expansion is related to the severity of recession, but only because of the initial "snap back" in the recovery period. Once the expansion reaches a more mature phase and the economy is operating at or near capacity, the strength or weakness of output growth should be basically uncorrelated with the severity of the preceding recession. Thus, the string plucking metaphor can explain why the second correlation in Table 1 is so much smaller in magnitude than the third correlation.

Meanwhile, it is interesting to note how far away the MA forecast for the 2007-09 recession and its recovery is from the fitted line in Figure 2. The MA forecast is in the lower right-hand corner of the figure and corresponds to a much weaker recovery than implied by the historical correlations or the plucking model idea of excess capacity producing a strong recovery. Possible reasons for predicting a weak recovery from the current recession are discussed later.

Simple Time Series Models of Output Growth Dynamics

The three correlations in Table 1 and the "plucking" metaphor have strong implications for the shape of recessions. However, to fully appreciate these implications, it is helpful to con-

sider some simple time series models of output growth, including models that try to capture the plucking model dynamic. Estimates for the various time series models are reported in Table 2.

First, the small positive correlation between output growth in expansion and output growth in the subsequent recession is consistent with positive serial correlation in quarter-to-quarter output growth. This is supported by the estimates for a simple AR(2) model of output growth, reported as Model 1 in Table 2. The sum of the autoregressive coefficients is 0.388, which suggests that, when output growth is above average, almost 40% of that above-average growth is expected to persist into the next quarter, all else equal.

In terms of the implied shape of recessions, first note that output growth is (by definition) below average after the economy enters into a recession. Thus, given a recession, Model 1 predicts ongoing below-average growth for a few quarters, after which the economy is predicted to return to its long-run growth rate. Notably, Model 1 does not predict any above-average growth rates in a recovery to offset the effects of the recession on the level of output. Thus, Model 1 implies "L"-shaped recessions and does not account for the two negative correlations in Table 1.

TABLE 2
SIMPLE TIME SERIES MODELS OF POSTWAR QUARTERLY OUTPUT GROWTH

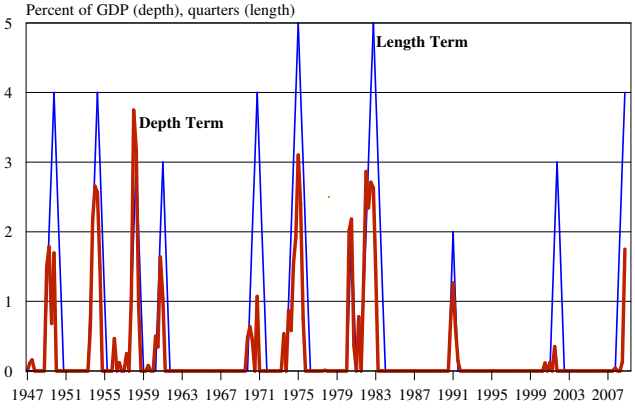
	Model						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	0.498	0.593	0.387	0.437	0.435	0.233	0.421
z-statistic	5.9	6.3	3.3	3.8	3.8	0.9	4.4
One quarter lagged output growth	0.308	0.343	0.424	0.35	0.346	0.339	0.358
z-statistic	4.8	5.5	6.3	5.2	5	4.8	6.0
Two quarter lagged output growth	0.08	0.08	0.162	0.187	0.189	0.186	0.192
z-statistic	1.2	1.3	2.4	2.9	2.9	2.9	3.1
Twelve quarter lagged output growth		-0.155	-0.165	-0.168	-0.168	-0.157	-0.168
z-statistic		-2.7	-2.9	-3	-3	-2.8	-3.1
Lagged Depth of Recession			0.303	-0.033	-0.051	-0.067	
z-statistic			2.9	-0.3	-0.3	-0.4	
Lagged Depth of Recession x NBER Recession				0.666	0.659	0.652	0.641
z-statistic				4.3	4.2	4.1	5.2
Lagged Max{Length Recession-Expansion,0}					0.016	-0.000	
z-statistic					0.2	-0.0	
Lagged Unemployment rate, civilian 16+						0.038	
z-statistic						0.9	
Adjusted R-squared	0.109	0.157	0.183	0.240	0.237	0.236	0.243

Note: Output growth is measured using 100 times natural log differences for U.S. Real GDP. The sample period is 1947Q2 to 2008Q4 (initial).

As a parsimonious model of output growth dynamics, an AR(2) model is hard to beat. However, it has long been believed by many economists and others that there is some tendency for persistent periods of above-average growth to be predictably offset by below-average growth and vice versa. A search for supportive evidence of this type of dynamic turns up a negative and significant AR(12) coefficient, as can be seen for Model 2 in Table 2.

As with the previous model, Model 2 still essentially implies "L"-shaped recessions, although, consistent with the pattern for the 1990-91 recession, the model can produce elongated "U"-shape patterns because the economy is predicted to experience slightly above-average growth three years after a recession. Certainly, this dynamic could explain why there is some negative correlation between growth in a recession and growth in the subsequent expansion. However, Model 2 does not account for the third correlation in Table 1. Specifically, the AR(12) coefficient implies a small negative correlation at a three-year horizon, rather than the strong negative correlation between growth in the recession and growth in the first year after the trough.

Figure 3
Depth and Length of Postwar Recessions



Notes: The sample period is 1947Q1 to 2008Q4 (final). Depth is the percentage deviation of U.S. real GDP from its historical maximum. Length is the maximum of zero or the then historical length of the most recent recession minus the then historical length of the subsequent recovery.

By contrast, Model 3 directly captures the "snap back" dynamic inherent in the third correlation in Table 1. Specifically, Model 3 adds a term that corresponds to the depth of a recession. Depth is measured in a given quarter by the percentage difference between the then historical maximum of real GDP and the prevailing level of real GDP in that quarter. This variable is displayed as the solid line in Figure 3 (ignore the dashed line for the time being). When output is at its then historical maximum, the depth term is zero. However, when a recession occurs and output falls below its historical maximum, the depth term increases. After a recession ends and output starts to catch up to its historical maximum, the depth term falls back towards zero. The depth term enters into the model with a positive coefficient of 0.303, which implies that, in a recovery, output growth will be higher by enough to catch up 30% of the distance between the previous level of output and its historical maximum every quarter, all else equal. This model is consistent with all three of the correlations in Table 1 and captures the plucking dynamic proposed by Milton Friedman.[3]

What does Model 3 imply about the shape of recessions? First, it generally argues against the prevalence of "L"-shaped recessions, although they could occur as a consequence of a mild recession that only pulls output a little bit below its historical maximum (e.g., the 1990-91 recession). Instead, the model suggests the prevalence of "U"- or "V"-shaped recessions, with the fact that the depth term starts to offset the effects of the lagged growth rates as a recession extends beyond its first few quarters implying "U"-shaped recessions in particular.

[3] Numerous academic papers have considered time series models with the depth of recession variable, most notably Beaudry, P. and G. Koop, 1993, "Do Recessions Permanently Change Output?" *Journal of Monetary Economics* 31, 149-63.

Model 4 allows for a formal test of whether the leveling out that is evident in the 1981-82 recession in Figure 1 is typical. In particular, the model considers whether the predicted effects of the depth term are the same during recessions as in expansions by adding the depth term interacted with a NBER expansion dummy variable that is equal to 0 during recessions and 1 during expansions. The estimates in Table 2 make it clear that the depth term really only matters for growth in expansions. The interacted depth term in Model 4 is highly significant, with the estimated "snap back" effect of 0.666 being twice as large as that for Model 3. Meanwhile, the original depth term is insignificant for Model 4. Thus, by suggesting that the depth of a recession only predicts higher growth once a recovery is underway, Model 4 supports the prevalence of "V"-shaped recessions, rather than "U"-shaped recessions, although the diversity of shapes in Figure 1 suggest that the model is capturing tendencies only. For example, assuming Model 4 captures the predictable dynamics in output growth, the "U" shape of the 1981-82 recession must be due to a particular sequence of unpredictable shocks as well as the predictable dynamics.

In thinking about the shape of the current recession that began in the last quarter of 2007, Figure 3 makes it clear why it matters a lot whether the strength of the "snap back" is more closely related to the depth of a recession or to its length (the dashed line). "Length" is measured by considering the maximum of zero or the then historical length of the most recent recession minus the then historical length of the subsequent expansion. Like the depth term, the length term increases from zero as a recession hits and extends from quarter to quarter. After the recession ends, the length term falls back towards zero as the expansion proceeds (the length variable is set to zero when the difference between the length of the recession and the length of the expansion becomes negative). Historically, depth and length are closely related, with the sample correlation between the depth and a length measures reported in Figure 3 being 76%. However, while the depth and length variables are closely linked in general, the current recession is already quite long, but only became deep in the fourth quarter of 2008. Thus, the strength of the recovery following the current recession will depend crucially on whether depth or length is more important.

Model 5 adds in the length term to the previous model. Notably, it is neither economically nor statistically significant. Thus, it appears that depth is what matters for the strength of recovery, not length. As a consequence, the recovery for the current recession implied by Model 5 will not be as strong as it would if length mattered more. Thus, the current recession, which started out mild and only became more severe at the end of 2008, might only have a lower-case "v" shape, although the fact that things may well get worse before they get better suggests that an upper-case "V" shape is also possible, at least according to Model 5.

In thinking about the economic reasons why the depth term might predict the strength of a recovery, it is clear that it is intended to capture excess capacity in the economy. However, it will only serve as an approximation because the historical maximum benchmark implicitly assumes no change in capacity over a recession and its recovery, contrary to the upward tilt of the wooden board in Milton Friedman's "plucking" metaphor. Thus, as a measure of economic slack, the depth term is generally too quick to return to zero after a recession is over.

The unemployment rate provides an alternative measure of economic slack that is designed to address an ever-changing level of capacity. The basic idea is that the "full-employment" level of the unemployment rate might be more stable over time than full capacity for real GDP and it could be captured by the constant in a regression. In order to check the relevance of this alternative measure of slack, Model 6 adds in the unemployment rate. Interestingly, even controlling for the depth term, the point estimates suggest that a high unemployment rate predicts higher future economic growth, implying that depth is, indeed, an imperfect measure of slack.

However, perhaps surprisingly, the unemployment rate is not statistically significant in Model 6. Furthermore, it should be noted that the unemployment rate cannot account for the correlations in Table 1 on its own. In particular, based on the estimation of Model 6, a low unemployment rate predicts lower future economic growth. Thus, considering Okun's law and the counter-cyclicality of the unemployment rate, the positive coefficient on the unemployment rate for Model 6 implies a negative correlation between growth in expansions and growth in the subsequent recessions, contrary to the small positive correlation in Table 1.

Model 7 removes the statistically insignificant terms from Model 6 and has the highest overall adjusted R-squared. The model implies that there is some positive short-horizon serial correlation and some negative longer-horizon serial correlation. But most importantly, it implies a large snap-back effect that relates the strength of recovery to the depth of the preceding recession. The model suggests the prevalence of "V"-shaped recessions and implies that the strength of recovery for the current recession will depend on "how low things go." The fact that the current recession, while already lengthy, was initially quite shallow suggests that the recovery will be somewhat muted, at least compared to recoveries following the 1973-75 and 1981-82 recessions. Thus, the predicted shape is a lower-case "v", with the chances of an upper-case "V" increasing with continuing severe negative growth in the first quarter of 2009 (more on this below). It is worth noting that, among other things, the possibility of a lower-case "v" suggests that recent widespread rumors about the death of the so-called "Great Moderation" may have been greatly exaggerated.

Is this time different?

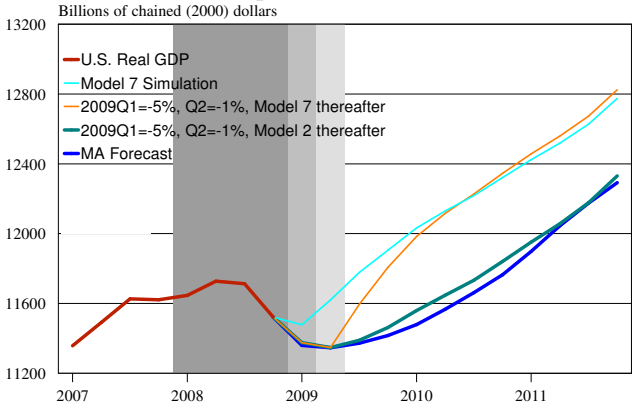
No two recessions are alike. The current recession is different from most postwar U.S. recessions because it is so clearly the consequence of a major financial crisis, while most postwar recessions appeared to have other causes, such as oil price shocks or monetary policy designed to bring down inflation. At the same time, there is little precedent for the scale and breadth of the counter-cyclical policy responses to this recession. Given these exceptional circumstances, it might be a mistake to extrapolate too much from the past behavior of output during recessions and their recoveries.

If the past U.S. experience provides little guidance for the shape of the current recession and its recovery, what alternative experience should be considered? Without venturing too far into a huge academic literature, suffice it to say that international experience with financial crises suggests large negative and permanent effects. Thus, perhaps, "L" is actually subliminal code for "Leverage" and a U.S. recession brought on by a financial crisis and the sub-

sequent de-leveraging of consumers and firms will have an "L" shape.[4] Of course, the unprecedented policy responses to this recession might also lead to questions about the relevance of past international experiences with financial crises.

Figure 4 provides some context for understanding what is at stake when deciding how much weight to put on the past experience by presenting four scenarios for the recovery from the current recession. In the first scenario, Model 7 and data up to 2008Q4 are used to simulate future real GDP by setting future shocks to zero. This simulation produces the lower-case "v" shape mentioned above.

Figure 4
Predicted Shape of the Current Recession



Notes: The figure displays U.S. real GDP up to 2008Q4 (final) and simulated future values. NBER recession dates are shaded, with predicted recession dates receiving lighter shading. The first simulation assumes that the recession continues through the first quarter of 2009, while the second and third simulations assume that the recession continues through the second quarter of 2009. The MA forecast is as of April 8, 2009. The growth rates given in the legend are expressed in annualized terms.

One problem with the simple models in Table 2 is that they do not have an endogenous mechanism for recessions. For the preferred model, recoveries are predicted to be strong based on deep recessions, but there is nothing in the model that captures or predicts deep recessions in the first place.[5] If, as it seems likely, things will continue to get worse before they get better, with output falling at a sharp rate in the first quarter of 2009 and possibly falling further in the second quarter, then the simulated path of real GDP will be quite different than when we assumed no further negative shocks. Along these lines, the second and third scenarios in Figure 4 reflect the assumption of -5% growth and -1% growth (annualized) in 2009Q1 and 2009Q2, respectively. For the second scenario Model 7 is applied to simulate future real GDP from 2009Q3 onwards, while for the third scenario Model 2 is applied for the same time period. The MA forecast is also presented as a fourth scenario for comparison.

The main thing to notice is that, if we consider Model 7, the "snap back" dynamic means that the economy essentially ends up in the same place by the middle of 2010, regardless of whether early 2009 involves a continuing severe contraction or not. The only thing that is affected in the simulation is the size of the "V". This conforms exactly to the "plucking"

[4] The large negative effects of financial crises on economic activity in emerging market economies are well known (e.g., the Asian financial crisis in 1997-98). But, even if financial crises in developed countries, such as what occurred in Sweden in 1991, would seem to be the more relevant experience for the United States, the implications are not particularly encouraging. Declines in output from peak to trough have been almost as severe in developed countries as emerging market countries (see Reinhart, C.M. and K.S. Rogoff, 2008, "The Aftermath of Financial Crises", Working Paper, http://www.economics.harvard.edu/faculty/rogoff/files/Aftermath.pdf). Also, based on panel data analysis, there appears to be no significant "snap back" after financial crises (see Cerra, V. and S.C. Saxena, 2008, "Growth Dynamics: The Myth of Economic Recovery", *American Economic Review* 98, 439-57). On the other hand, among major developed countries, the United States stands out as having particularly strong recoveries following deep recessions (see Kim, C.-J., J. Morley, and J. Piger, 2005, "Nonlinearity and the Permanent Effects of Recessions", *Journal of Applied Econometrics*, 20, 291-309).

[5] It is possible to model recessions endogenously using Markov-switching variables. Estimation of Markov-switching models is more complicated than the simple models presented in Table 2. However, the implied recovery dynamics from such models are often similar to those from the simple models considered here, while recessions, once they have begun, are expected to persist from quarter to quarter in such models with an estimated probability of about 75% for postwar U.S. data. This implies that, from any point in a recession, it will be expected to last for another 4 quarters. For an estimated Markov-switching version of the Friedman plucking model, see Kim, C.-J. and C.R. Nelson, 1999, "Friedman's plucking model of business fluctuations: Tests and estimates of permanent and transitory components", *Journal of Money, Credit, and Banking* 31, pp. 317-334.

dynamic championed by Milton Friedman. Meanwhile, if we consider Model 2 as the appropriate model in the wake of a financial crisis, we get a very clear "L"-shaped recession. The MA forecast is also consistent with an "L"-shaped recession, at least through 2011. Annual real GDP growth in the MA forecast for 2009 and 2010 is -0.9% and 3.0%, respectively. However, note that, despite implying considerably lower output than Model 7, the MA forecast corresponds to somewhat faster growth than the Blue Chip consensus forecast, which predicts annual growth of -1.3% and 2.7% for 2009 and 2010, respectively.

The empirical findings in Table 2 argue strongly against Model 2 relative to Model 7. However, as alluded to above, the future may not always be like the past. Or, at least, the future for the United States may be more like the past for other countries that have suffered major financial crises than the past for the United States. This is clearly the view put forth in the recent *IMF World Econonic Outlook*, which employs cross-country analysis to argue that the next recovery will be weak because it follows both a financial crisis and a globally synchronized recession.[6] Yet, before we throw our hands up in despair of predicting the future using past data, it should be noted that, if the past U.S. experience were generally such a poor guide for its future, we should expect to see more structural breaks in the past dynamic behavior of U.S. real GDP. While there is a clear and well-known structural break in output volatility in 1984 that corresponds to the Great Moderation mentioned above, there is no corresponding evidence for a break in dynamics. For example, a Chow test for a one-time break in the conditional mean parameters for Model 7 in 1984Q1 produces an F-statistic of 0.243 with a p-value of 0.94, suggesting no statistical support for a structural break in the dynamics implied by this model.[7]

Meanwhile, it should be emphasized that the contrast between the first two scenarios in Figure 4 makes it clear that a strong recovery is not desirable for its own sake if it is merely the consequence of a deeper recession and the concomitant underutilization of resources. Indeed, somewhat ironically given its originator, the most striking implication of Milton Friedman's plucking model is that, to the extent that policy can mitigate business cycle fluctuations, large policy responses to economic crises can raise the average level of output by reducing the cumulative loss of output associated with recessions. Specifically, the plucking model implies the possibility of "filling in the trough without shaving off the peak."

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[6] See the International Monetary Fund's *World Economic Outlook*: *Crisis and Recovery* April 2009, Chapter 3, pp. 103-138. (http://www.imf.org/external/pubs/ft/weo/2009/01/pdf/c3.pdf). It is interesting to note that key examples of previous globally synchronized recessions presented in the IMF study occured in the mid-1970s and the early 1980s. These episodes corresponded to recessions that led to high-growth recoveries in the United States, even if the recoveries were weaker in many other countries. Thus, the relevance of the IMF analysis for the United States hinges on the questionable notion that the experience of other countries after these recessions is more relevant for the United States than its own experience. Meanwhile, in terms of previous financial crises, it should also be noted that, even in the case of the Great Depression, which involved a catastrophic financial crisis, the recovery in the United States, while long delayed, was ultimately strong, bringing the economy back to its previous trend level and conforming to a "large font" version of the "V" shape dynamic found in the postwar U.S. data.

[7] Beyond the link to the Great Moderation, a break in 1984 also separates the overall sample period into a pre-break era with known high growth recoveries (e.g., after the 1973-75 and 1981-82 recessions) and a post-break era with weaker "jobless" recoveries (e.g., after the 1990-91 and 2001 recessions). However, even given this delineation of the sample that might seem to favor structural change in dynamics, there is no evidence for a change. The simple reason is that the depth of recession was small in the post-break era, meaning that the model actually did a good job of predicting the weak recoveries.

Conclusion

There is a strong historical "snap back" relationship between the strength of economic recovery and the severity of the preceding recession. Thus, recessions and their recoveries have a tendency to trace out a "V" shape. Because the current recession that began at the end of 2007 started out shallow and only recently became deep, a simple time series model of the "snap-back" dynamic implies that the current recession may have a lower-case "v" shape, although the fact that the economy is likely to continue to contract further before a recovery takes hold argues for the possibility of an upper-case "V". On the other hand, because the current recession was brought on by a financial crisis, there is clearly more of a downside risk than upside risk to the predicted strength of recovery, even given a robust policy response. Meanwhile, in contrast to the "V" shape prediction based on a simple time series model, the MA forecast is more in line with an "L" shape to the recession and recovery, at least in the near term.