

Consumption Growth Regimes and the Post-Financial Crisis Recovery

By Andrew Foerster and Jason Choi

The financial crisis and recession of 2007–09 hit household balance sheets hard and resulted in large numbers of job losses. Diminished wealth and income, high unemployment, and a stagnant labor market—in combination with tight borrowing and lending conditions—made it difficult for households to increase consumption as rapidly as they had just a few years earlier. After the Great Recession, consumption has grown more slowly than in the recoveries from previous recessions, suggesting a fundamental shift in the economy.

Consumption growth reflects a variety of both persistent and transitory factors. Shifts in underlying factors such as labor markets or financial conditions can persistently change the speed and volatility of consumption growth; other determinants of consumption such as weather or temporary tax changes can have transitory effects. Characterizing consumption growth during the recovery as being due to either persistent or transitory factors can help determine exactly how the recovery differed from previous ones. If the factors driving consumption growth are fundamentally different now from the past, previous recoveries may no longer indicate how the economy might rebound from recessions. But if the factors driving consumption growth are not too different, previous recessions still may provide insight into how consumption growth may evolve.

Andrew Foerster is a senior economist at the Federal Reserve Bank of Kansas City. Jason Choi is a research associate at the bank. This article is on the bank's website at www.KansasCityFed.org.

In this article, we compare consumption growth's historical behavior with its behavior during the recovery from the Great Recession. We conclude that the slow growth was due not to a shift to previously unseen behavior, but rather the continued influence of persistent factors that are unusual to see outside recessions. While durables and nondurables consumption behaved much as they did during previous recoveries, both total and services consumption saw an atypical continuation of recessionary behavior during the recovery. If the recessionary behavior had not continued, the United States would have had higher total and services consumption throughout the expansion. Section I presents a graphical analysis of consumption growth after recessions. Section II presents a statistical model demonstrating that growth of total consumption and its components did not behave differently during the recovery but merely returned to previously seen behavior. Section III uses the statistical model to highlight that while factors driving consumption growth in the previous recovery mimicked those in history, their behavior in the cases of total and services consumption was unusual for periods immediately after recessions.

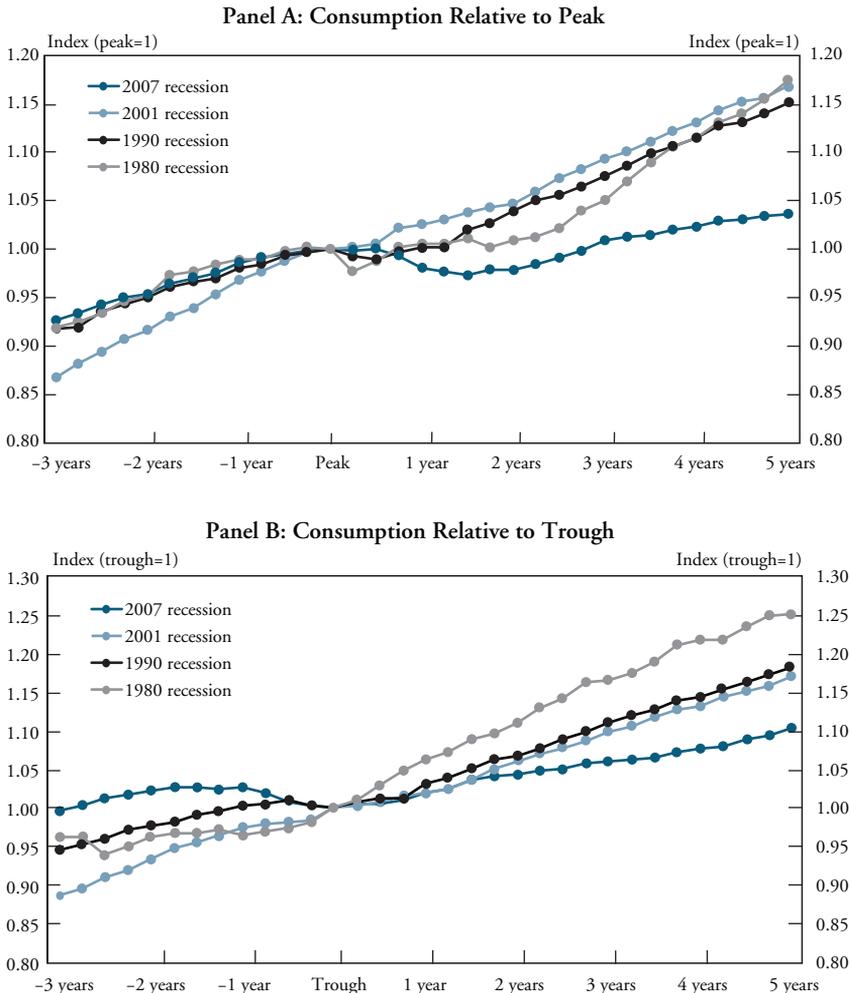
I. A Graphical Perspective on Consumption Growth after Recessions

One method for gauging the speed of recoveries involves graphing and comparing normalized consumption series across several recessions. This method indicates the relative speeds of consumption growth and its components after recessions and suggests that the slow recovery in total consumption from the 2007 recession was primarily due to sluggish services growth.

A graphical perspective of consumption growth

Graphs comparing the paths of total consumption across different recessions can illustrate, by historical standards, how normal or abnormal growth was after the 2007 recession. Chart 1 displays real consumption series for the last four business cycles.¹ Panel A shows these series normalized to equal 1 in the quarter of the previous expansion's peak, which represents the start of each recession. Panel B shows a similar graph with the series normalized to equal 1 in the quarter of each recession's trough, which represents the end of each recession.

Chart 1
Consumption over the Business Cycle



Sources: Haver Analytics, Bureau of Economic Analysis and authors' calculations.

Normalizing the series at two different points in the business cycle allows the panels to show different perspectives on how consumption behaved during and after the recessions. In both panels, the slope of the lines indicates the growth rates over each business cycle, with steeper slopes indicating faster growth rates. The level of the line accumulates these growth rates to show the relative size of consumption.

Regardless of the normalization, the recovery from the 2007 recession looks quite weak compared with previous recessions. Panel A (consumption normalized across peaks) shows that the relative level of consumption after the 2007 recession was well below its relative level after previous recessions. In addition, consumption continued to decline for more than a year after the recession's peak; in previous recessions, consumption resumed its upward climb almost immediately. The sharp and persistent drop in consumption after the peak reflects that the 2007 recession was much deeper and drawn out than previous recessions. Panel B (consumption normalized across troughs) reinforces this conclusion. Although consumption grew steadily after the 2007 recession's trough, its growth clearly lagged behind that of previous recoveries; two years after the trough, growth was especially slow. This graphical analysis highlights that the 2007 recession had not only a longer-lasting and larger decline than previous recessions, but also languishing growth in the years that followed.

Although normalized charts effectively illustrate the decline in consumption growth after the 2007 recession, they are less useful in explaining the source of this decline. Furthermore, analyses based on total consumption may mask differences among the subcomponents of consumption, which differ in how they behave during and after recessions.

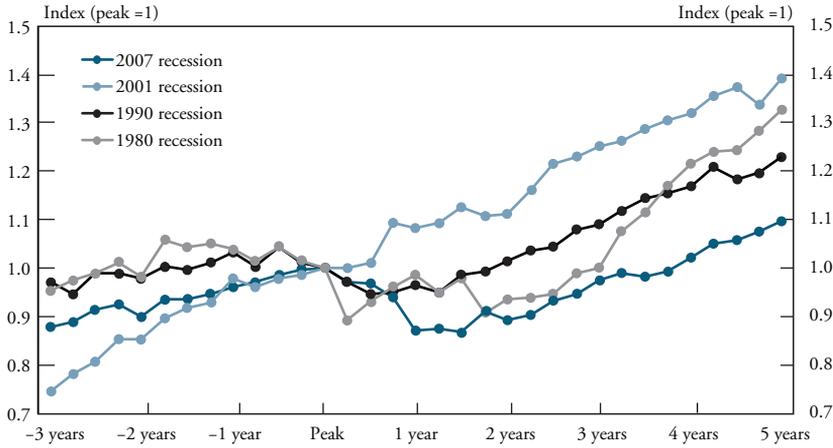
A graphical perspective of consumption growth by component

Consumption is divided into three components: durables, nondurables, and services. Durables account for approximately 12 percent of total consumption and include items that are typically purchased infrequently such as vehicles, furnishings, and household appliances. Nondurables make up around 22 percent of consumption and include more regularly purchased items such as restaurant meals, clothing, and gasoline. Services make up the remaining 66 percent of consumption and include expenditures on housing, utilities, health care, and financial services.²

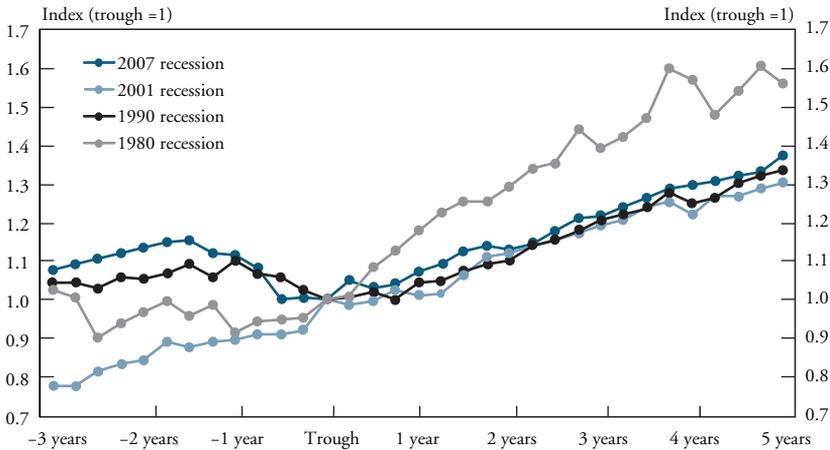
The three components of consumption—durables, nondurables, and services—behave differently over the business cycle. Similar to Chart 1, Charts 2, 3, and 4 compare these components of total consumption relative to the peaks and troughs of past business cycles.

Chart 2
Durables Consumption over the Business Cycle

Panel A: Durables Consumption Relative to Peak



Panel B: Durables Consumption Relative to Trough



Sources: Haver Analytics, Bureau of Economic Analysis and authors' calculations.

Panel A of Chart 2 plots durables consumption across past business cycles relative to their peaks. Under this normalization, the recovery after the 2007 recession looks slow by historical standards. However, in Panel B, which plots consumption relative to business cycles' troughs, the recovery looks normal. The overall trends are largely consistent with those shown for total consumption in Chart 1. However, durables

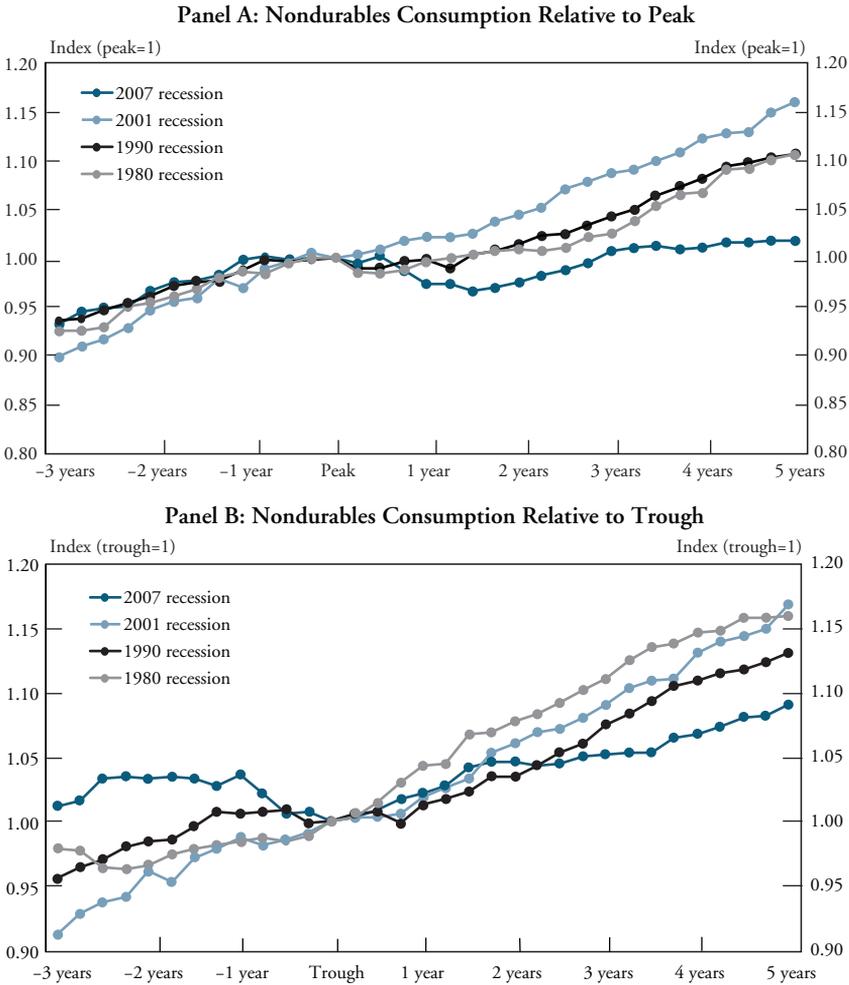
fluctuate more than total consumption. These sharp movements imply significant volatility in the growth rates of durables consumption. Both the prolonged downturn and the higher volatility of durables may result from consumers delaying purchases of durable goods when economic conditions warrant caution. When financial conditions are tight, consumers may find it necessary to postpone purchases of cars or large household items rather than cut back on small, recurring household purchases.

As with durables, nondurables consumption behaved somewhat differently than total consumption during and after the 2007 recession. Panels A and B of Chart 3 show the normalized paths for nondurables consumption. Relative to the business cycle's peak, nondurable consumption growth looks weak in the most recent recovery, although this weakness partially reflects the longer-than-usual decline in nondurables consumption during the recession. Relative to the business cycle's trough, nondurables consumption looks in line with previous recoveries for the first two years; thereafter, growth stalls and nondurables flatten for about two years before resuming their previous growth. Consequently, five years after the 2007 business cycle's trough, the level of nondurables consumption lags its level in previous recoveries. However, this may be due to a temporary slowdown in growth two to four years after the recession ended rather than persistently weak growth throughout the entire recovery. The volatility of nondurables consumption growth again appears to be higher than for total consumption, although not quite as high as durables consumption. Postponing purchases of many of the goods making up nondurables, such as clothing, may be relatively difficult, leading to somewhat less volatility than durables consumption.

Services consumption, as plotted in Chart 4, behaved quite differently after the 2007 recession than after previous recessions. When compared across peaks and troughs, the growth of services consumption looks weak relative to previous recoveries. In fact, in the first year after the business cycle's peak, the path of services consumption mimics those in previous episodes, implying that differences among the recoveries, not the recessions, are primarily responsible for the change. In addition, services consumption contrasts with both durables and nondurables in that the paths look extremely

Chart 3

Nondurables Consumption over the Business Cycle



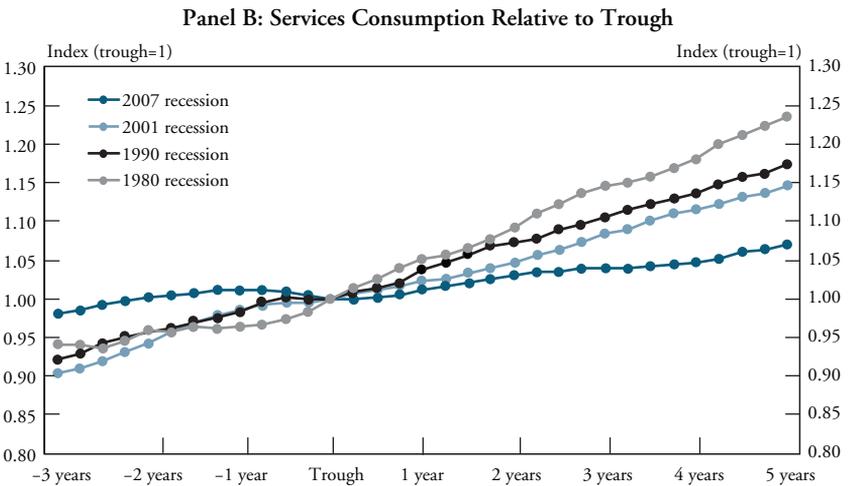
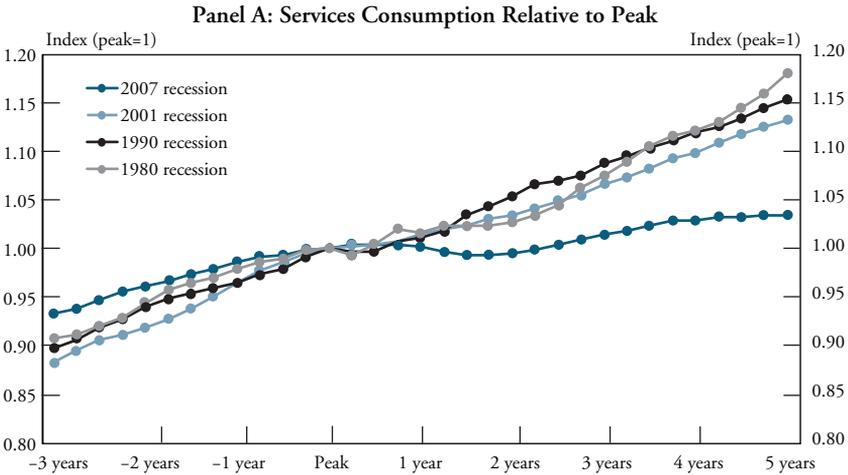
Sources: Haver Analytics, Bureau of Economic Analysis and authors' calculations.

smooth, implying much less variation in growth rates. Consumers essentially avoid postponing services such as health care or housing, leading to very stable growth in services consumption.

The components of consumption paint a more nuanced picture of consumption during recoveries than the total series does. While total consumption growth after the 2007 recession looks weaker than in previous recoveries, its components suggest tepid growth in services, which

Chart 4

Services Consumption over the Business Cycle



Sources: Haver Analytics, Bureau of Economic Analysis and authors' calculations.

accounts for around two-thirds of total consumption, is primarily to blame. However, this graphical analysis is limited in certain respects. First, by focusing exclusively on performance relative to peaks or troughs, the plots may obscure longer-term trends. Second, the graphical analysis does not clearly indicate whether growth in consumption and its components reflects transitory or persistent factors, nor does it explain how

these factors may have differed from those underlying previous recessions. To account for these limitations, we turn to a statistical model that does not rely on comparisons across peaks and troughs to help decompose consumption growth into persistent versus transitory elements.

II. Consumption Growth Regimes

Graphical analysis indicates that total consumption growth during the recovery from the 2007 recession was low relative to historical standards, primarily due to slow growth in services. To evaluate whether the 2007 recession fundamentally changed the behavior of consumption growth, we construct a statistical model for both total consumption growth and its three components that allows growth to evolve differently across time and to depend on both persistent and transitory factors.

To allow for persistent shifts in the behavior of consumption and to distinguish those shifts from transitory movements, our statistical model allows consumption growth to depend on different “regimes” that dictate the average level or volatility of growth. These regimes capture distinct shifts in the behavior of consumption which can happen suddenly—such as during the onset or end of a recession—instead of gradually. By modeling consumption as dependent on separate growth and volatility regimes, we can capture a wide range of possible factors that may affect the average level or volatility of growth independently rather than together. Changes in fiscal policy, for example, might alter the average growth rate of consumption while leaving its volatility unchanged; likewise, foreign shocks might lead to large fluctuations in consumption without changing its average growth rate. Separating average growth and volatility regimes allows us to capture a more nuanced view of consumption growth at various points in history.

Estimates from the model suggest consumption and its components do not grow in a stable manner over time. Total consumption growth and its services component oscillate between two regimes with different average growth rates; both total consumption and services stayed in the low average growth regime during the most recent recovery. In contrast, both durables and nondurables consumption have only one regime with a constant average growth rate, implying they did not deviate from their historical behavior. Total, durables, and nondurables consumption all exhibit high- and low-volatility regimes; after briefly entering the

high-volatility regime during the recession, all three components of consumption returned to the low-volatility regime. In contrast, services consumption has only one volatility regime over time.

A statistical model for consumption growth

To assess whether persistent or temporary factors drove consumption growth in the most recent recession, we use a statistical model known as a Markov-switching model, introduced by Hamilton, which allows us to relate the quarterly growth rate of total consumption or one of its three components to a level and a volatility term. This model allows the level and volatility to vary over time between regimes. The model is as follows:

$$\Delta C_t = \mu(S_t) + \sigma(V_t) \varepsilon_t.$$

The variable ΔC_t represents the quarterly percent change in either total consumption or one of its components—durables, nondurables, or services. The variable $\mu(S_t)$ denotes the average level of consumption growth, which varies according to the regime S_t . The variable $\sigma(V_t)$ denotes the volatility of consumption growth, which varies according to the regime V_t . The shock ε_t accounts for differences in consumption growth from the average level and is scaled by the volatility term.³

The variables S_t and V_t allow the average level of consumption growth and its volatility to take one of several values at each point in time—that is, they tie consumption growth and volatility to a value dictated by the regime. These regimes offer a reduced-form way to capture a variety of factors such as wage growth, financial conditions, household expectations, or policy that affect consumption growth. Decomposing growth into these different regimes helps assess whether persistent factors—indicated by shifts in the average level of growth, $\mu(S_t)$ —or temporary factors—indicated by the size of the composite error term, $\sigma(V_t)\varepsilon_t$ —played a larger role. For example, in explaining low consumption growth in a given quarter, if the statistical model shows a low average level of growth with a small error term, then persistent factors may be at play, and growth may be low in the future. On the other hand, if the model shows a high average level of growth and a low realization of the error term, then more transitory factors are to blame, and growth should be higher in the future.

The number of regimes used to characterize average growth and volatility can dramatically alter the conclusions. To determine the correct number of regimes, we review specifications with one, two, or three regimes for each of S_t and V_t and pick the version of the model that best fits the data. For example, if the model allows average growth, S_t , to have three regimes, then the economy can have three different average growth rates: low, medium, and high. If the model allows S_t to have two regimes, then the economy can have two growth rates: low or high. And if the model allows S_t to have only one regime—low for simplicity—then the average growth rate remains unchanged. The regimes available for volatility, V_t , are similar.

After determining the preferred specification and analyzing how similar or different the regimes are from one another, the model can attribute them to different time periods and identify how consumption growth behaved in those periods. This method allows for a previously unseen regime—in other words, one that was not in place during previous recoveries—to arise and dictate consumption growth during the current recovery, which would suggest markedly new consumption behavior. But the method also allows for the regime in place during the recovery to simply be a repeat of a previous regime, which would suggest consumption growth similar to previous recoveries.

The evolution of the regimes follows a Markov process, which implies that the regime in a given period depends probabilistically on the regime in the previous period. For example, the probability P_{ll}^{μ} denotes the probability that the economy will be in the low average growth regime in one period if it was in the low average growth regime the previous period. Similarly, the probability P_{lb}^{μ} denotes the probability of switching from the low average growth regime in one period to the high average growth regime in the next. Corresponding probabilities exist for the volatility variable, $\sigma(V_t)$, and for each possible combination of regimes. The regimes for average growth and volatility evolve according to independent processes (see Kim and Nelson, McConnell and Perez-Quiros, and Lettau and others).

Consumption growth regimes

To characterize the behavior of total consumption growth, we first need to determine the number of regimes that average growth and

volatility can enter. This determination matters significantly for consumption dynamics, since one regime for the average growth rate implies that consumption growth behaves stably, whereas three regimes implies that consumption switches between high, medium, and low average growth regimes. Likewise, multiple volatility regimes might signal that consumption growth switches between a low-volatility regime, in which it fluctuates only slightly from its average level, and a high-volatility regime, in which it fluctuates significantly from its average level.

We compare different specifications for the number of regimes using goodness-of-fit statistics and find consumption growth is best characterized using two level and two volatility regimes. The values of the Schwarz-Bayesian Information Criterion (SBIC) measure, shown in the first column of Table 1, assess how well the model with various numbers of regimes fits the data while penalizing the inclusion of additional regimes. Lower values of the SBIC imply more favorable model specifications, with the lowest value achieved in the “2 Average, 2 Volatility” specification.⁴ As a result, we use this specification in the model, which suggests consumption growth tends to fluctuate between low and high average growth regimes and low- and high-volatility regimes. The economy switches between four regimes in total, with the following combinations of the average growth and volatility regimes: low average growth and low volatility, low average growth and high volatility, high average growth and low volatility, and high average growth and high volatility. As the average growth and volatility regimes are independent from one another, the probabilities of switching between each of these four regime combinations simply depend on the probabilities of switching between each part of the combination. For example, the probability of staying in the low average growth and low-volatility regime is given by $P_{ll}^{\mu} P_{ll}^{\sigma}$, the probability of switching to the low average growth and high-volatility regime is $P_{ll}^{\mu} P_{lb}^{\sigma}$, and so on.

Table 2 shows that the estimated values for this model differ greatly in the low and high average growth regimes as well as the low- and high-volatility regimes. In the low average growth regime, quarterly total consumption growth averages (0.45 percent) around 1.81 percent at an annualized rate. In the high average growth regime, quarterly total consumption growth (1.03 percent) more than doubles, averaging 4.17 percent at an annualized rate. Similarly, the high-volatility regime is more than twice as volatile as the low-volatility regime.

Table 1
 Schwarz-Bayesian Information Criterion (SBIC)
 for the Markov-Switching Models

Number and type of regime	SBIC			
	Total consumption	Durables consumption	Nondurables consumption	Services consumption
1 average, 1 volatility	553.94	1,304.58	566.35	354.17
1 average, 2 volatility	537.66	1,279.23*	558.36*	359.48
1 average, 3 volatility	544.30	1,295.70	578.99	382.96
2 average, 1 volatility	538.65	1,307.40	565.30	305.35*
2 average, 2 volatility	530.10*	1,289.86	565.48	308.60
2 average, 3 volatility	533.91	1,289.06	570.61	323.44
3 average, 1 volatility	546.24	1,307.63	584.30	310.44
3 average, 2 volatility	537.82	1,302.56	579.21	312.09
3 average, 3 volatility	543.73	1,303.07	581.62	315.42

* Denotes the preferred model with the lowest SBIC

The estimates for the probabilities show that both the average growth and volatility regimes are likely to persist for several quarters. The low average growth regime has an expected duration of around eight quarters, while the high average growth regime has an expected duration of around 15 quarters.⁵ The volatility regimes last even longer, with expected durations for the low- and high-volatility regimes of around 36 quarters and 64 quarters, respectively.

Consumption growth regimes by component

To gain a more nuanced view of the number and behavior of regimes, we repeat the statistical analysis on the individual components of consumption. We use similar goodness-of-fit statistics to pick the preferred number of regimes for each component. The preferred number of regimes varies across components, and the estimated coefficients indicate the components' behavior differs across regimes.

Table 2
Average Growth Rates and Volatilities across Consumption Regimes

Panel A: Average Growth Rates				
Average growth regime	Consumption	Durables	Nondurables	Services
Low	0.45 (6.18)	1.61 (12.08)	0.61 (15.21)	0.32 (5.87)
High	1.03 (20.14)	--	--	1.03 (32.03)
Prob. low -> low	0.88 (2.59)	--	--	0.86 (3.25)
Prob. high -> high	0.93 (3.78)	--	--	0.95 (6.07)

Panel B: Volatilities				
Volatility regime	Consumption	Durables	Nondurables	Services
Low	0.31 (8.10)	1.00 (7.20)	0.43 (8.47)	0.37 (16.14)
High	0.75 (18.34)	3.77 (23.41)	0.95 (11.00)	--
Prob. low -> low	0.97 (3.84)	0.84 (3.52)	0.89 (3.38)	--
Prob. high -> high	0.98 (5.11)	0.94 (7.20)	0.88 (2.92)	--

Note: t-statistics in parentheses.

The goodness-of-fit statistics for the models of durables, nondurables, and services consumption imply the preferred models differ from that for total consumption (Table 1). For example, the preferred model specification for durables and nondurables consumption has a single average growth regime and two volatility regimes. As a result, unlike total consumption, which switches between high and low average growth regimes, durables and nondurables consumption do not switch average growth regimes over time. However, these components do switch between low- and high-volatility regimes, suggesting that growth in durables and nondurables fluctuates more in some periods than in others. In contrast, the preferred model for services consumption has one volatility regime and two average growth regimes. These regimes imply that services consumption experiences periods of both high and low average growth but that its volatility does not change around those average levels.

The estimated coefficients for the preferred durables and nondurables models show that both their average growth rates and volatility differ from total consumption. The single average quarterly growth regime estimates for the durables and nondurables model (1.61 percent and 0.61 percent, respectively) are 6.6 percent and 2.5 percent at an annualized rate (Table 2). The volatility estimates show standard deviations in the high-volatility regime are much higher than in the low-volatility regime—by more than a factor of two for nondurables and by nearly a factor of four for durables. The particularly large deviations in durables growth may reflect that consumers can more easily postpone purchases of durables than nondurables, leading to more variation in durables growth over time. The estimates of the probabilities show growth for both durables and nondurables has a lower chance of remaining in the low- or high-volatility regimes than total consumption does. For durables, the low-volatility regime has an expected duration of slightly over six quarters, while the high-volatility regime has an expected duration of nearly 16 quarters. For nondurables, both volatility regimes have an expected duration of between eight quarters and nine quarters. These estimates suggest durables and nondurables switch more frequently between volatility regimes than total consumption.

The estimates for the services consumption model mimic the average growth results for total consumption. In the low average growth regime, quarterly services consumption (0.32 percent) grows around 1.31 percent at an annualized rate. In the high average growth regime, services consumption (1.03 percent) grows around three times faster, at approximately 4.17 percent at an annualized rate. The probabilities show that the high average growth regime tends to persist longer than the low average growth regime; their expected durations are around 21 quarters and seven quarters, respectively. In addition, in the single volatility regime, the standard deviation for services is lower than in either volatility regime for durables and nondurables, highlighting that consumption growth for services tends to be much more stable than for other components.

III. Consumption Growth Regimes across History

The previous section modeled consumption growth under different regimes and demonstrated that growth behaves differently across them. In this section, we apply the estimates from the statistical model to historical fluctuations in consumption to infer which regimes held during which times. Our results show that total and services consumption often enter the low average growth regime during recessions and switch to the high average growth regime during recoveries; however, in the recovery after the most recent financial crisis, total and services consumption remained in the low average growth regime. A counterfactual exercise suggests that if consumption had returned to the high average growth regime during the recovery, total and services consumption would have followed more traditional paths.

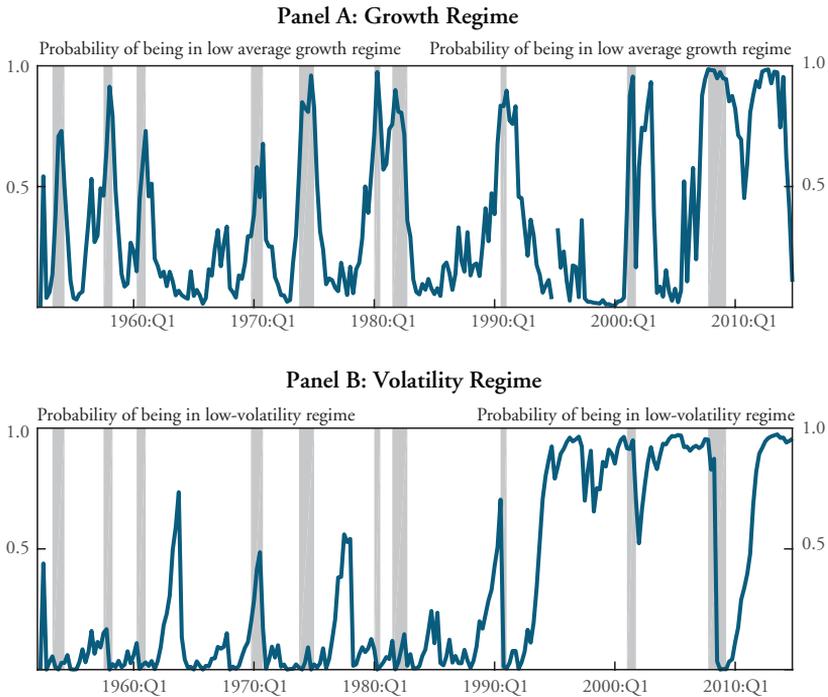
Historical decomposition of consumption regimes

Although total consumption grew slowly by historical standards after the most recent crisis, the slow growth resulted not from a fundamental change in consumption behavior—in other words, not from the appearance of a new, third regime—but from an extension of the low average growth regime not typically seen during recoveries. Since the regime in place is unobserved, the statistical model places relative probabilities on being in each regime at given points in time. For each quarter in the sample, the model takes into account all of the data and places a probability—called the smoothed probability—on whether the economy was more likely to be in the low or high average growth or volatility regime at any point in time.⁶

The smoothed probabilities for total consumption growth regimes show an unusual combination of regimes during the recovery after the 2007 recession. Chart 5 shows the smoothed probabilities for total consumption growth: Panel A shows the probability the model places on consumption being in the low average growth regime, while Panel B shows the probability of being in the low-volatility regime. Panel A conditions on being in the low average growth regime but allows either volatility regime to be in place. Likewise, Panel B conditions on being in the low-volatility regime but allows either average growth regime to be in place. The blue line in Panel A spikes upward in most of the shaded regions, suggesting consumption was more likely to be in the

Chart 5

Consumption Growth and Volatility Regimes



Note: Gray bars denote NBER-defined recessions.

low average growth regime during recessions, when consumption tends to fall or exhibit very weak growth. Panel B suggests the low-volatility regime became much more likely starting in the early 1990s. However, the most recent recession and recovery saw important departures from these first two trends. In particular, the high-volatility regime reappeared during the downturn and persisted well into the recovery. The low average growth regime also dominated for most of the recovery, in contrast to the usual quick shift after recessions back to the high average growth regime. As a consequence, total consumption growth tended to have a lower average and a higher volatility during the post-financial crisis recovery than typical recoveries.

Historical decomposition of consumption regimes by component

While total consumption had two possible average growth regimes during the crisis, both durables and nondurables had only one; in addition, the smoothed probabilities for the two volatility regimes show the high-volatility regime tended to hold during recessions. Charts 6 and

7 depict the smoothed probabilities for durables and nondurables consumption. Since the preferred model has only one average growth regime, the plots show only the probability of being in the low-volatility regime. Unlike total consumption, the implications of the probabilities for durables and nondurables are not as clear-cut. The probabilities do not readily match with recessions or recoveries, nor do they show clear shifts at any one time. However, both durables and nondurables entered the high-volatility regime during the recent financial crisis and recession and switched to the low-volatility regime during the current recovery. This result implies that durables and nondurables consumption growth tended to be relatively close to their average values during the recovery after exhibiting much bigger swings during the crisis.

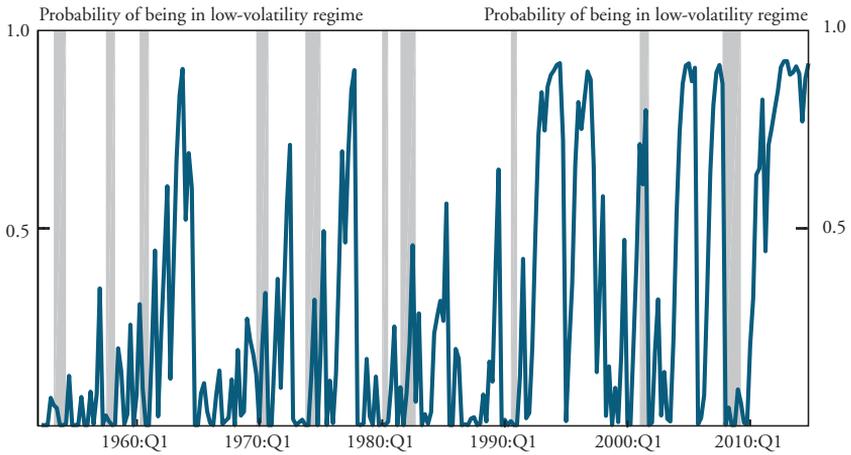
The probabilities for services consumption are similar to those for total consumption. Chart 8 displays the probabilities of services consumption being in the low average growth regime, since the preferred model has two average growth regimes but only one volatility regime. Similar to the results for total consumption, the low average growth regime for services tends to hold during recessions. Again, in contrast to typical recoveries, the low average growth regime dominated in the post-financial crisis recovery. While past recessions saw rapid shifts back to the high average growth regime, the low average growth regime persisted after the 2007 financial crisis.

Counterfactual regimes in the post-financial-crisis recovery

The statistical model places relatively high probability on the economy being in the low average growth regime for total and services consumption even after the most recent recession ended. A counterfactual exercise can assess what the path of consumption would have looked like during this time if the economy had switched to the high average growth regime, as was typical after most recessions.

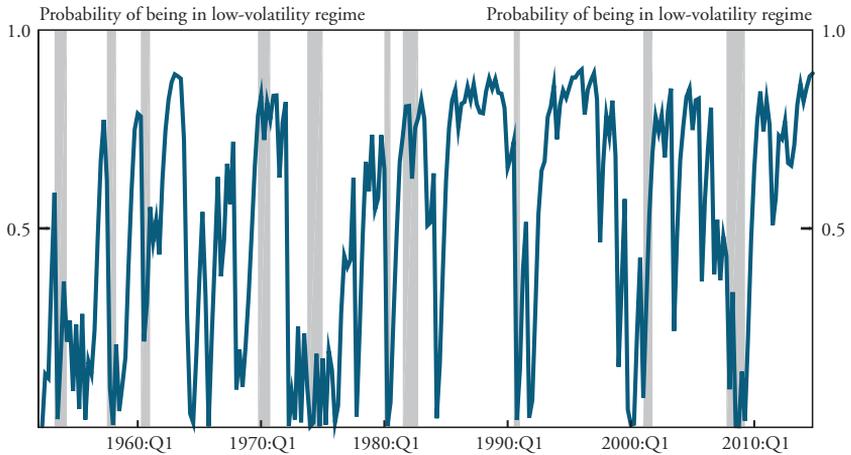
The model plays a central role in developing this alternative scenario. Since the model attributes consumption growth to changes in the average level or to transitory deviations from that average level, a scenario that considers different average levels of consumption growth allows us to identify the effects of potentially persistent changes in the growth rate. As our preferred model for durables and nondurables con-

Chart 6
Durables Consumption Volatility Regime



Note: Gray bars denote NBER-defined recessions.

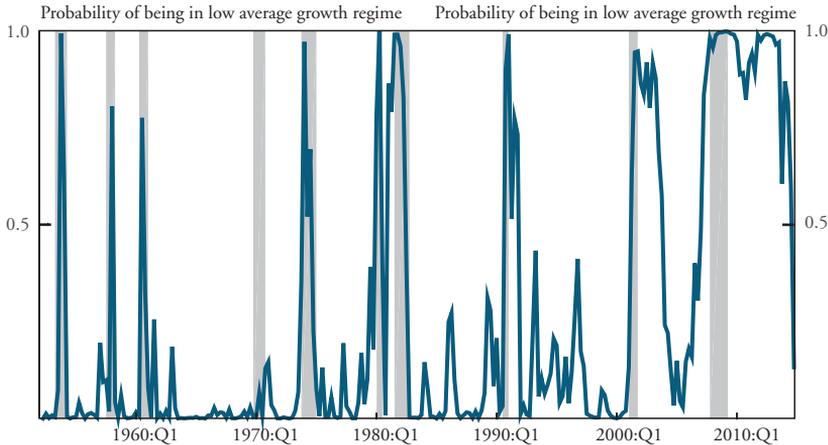
Chart 7
Nondurables Consumption Volatility Regime



Note: Gray bars denote NBER-defined recessions.

Chart 8

Services Consumption Growth Regime



Note: Gray bars denote NBER-defined recessions.

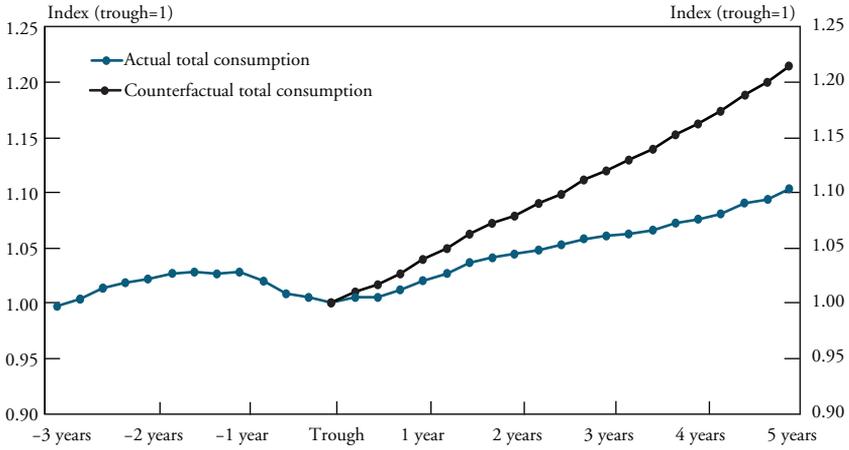
sumption growth has only one growth regime, any deviations from the average growth rate are completely transitory. Our preferred models for total and services consumption, however, have two average growth regimes, allowing deviations from the average growth rate to persist. In this way, a counterfactual that changes the average growth rate regime implicitly considers an alternate history that changes factors that persistently alter consumption dynamics—such as financial constraints, fiscal policy, or changes in productivity—rather than those that only transitorily alter consumption growth, such as weather.

The counterfactual series shows that total and services consumption would have been much higher if the economy had switched back to the high average growth regime after the trough. Chart 9 shows the actual and counterfactual series for total and services consumption for the latest business cycle, normalized to equal 1 in the second quarter of 2009 (the recession's trough). The counterfactual shows a more rapid increase in total and services consumption relative to the actual series. By the middle of 2014, five years after the end of the recession, actual total consumption was only 10.4 percent higher than it was when the recession ended; in contrast, in the counterfactual series, total consumption is around 21.5 percent higher. Similarly, actual services consumption was only 7.1 percent higher by the middle of 2014 than

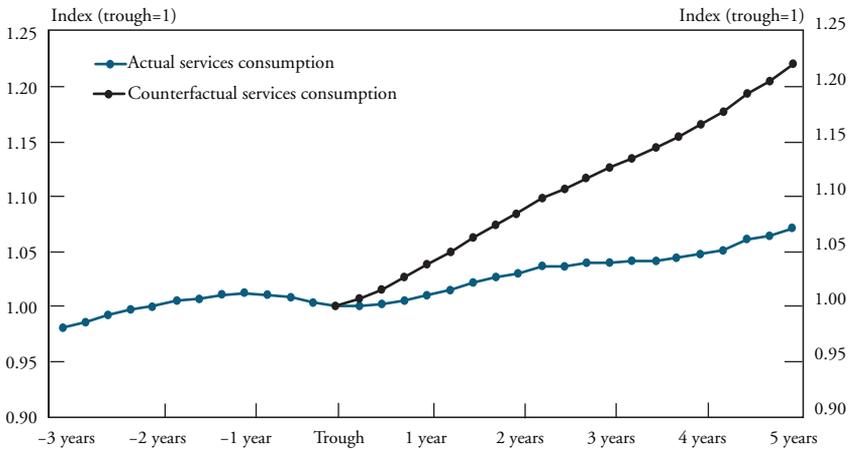
Chart 9

Counterfactual Consumption after the Great Recession

Panel A: Consumption Relative to 2007 Recession Trough



Panel B: Services Consumption Relative to 2007 Recession Trough



Sources: Haver Analytics, Bureau of Economic Analysis and authors' calculations.

it was at the end of the recession; in the counterfactual series, services consumption was 21.9 percent higher.

These counterfactual exercises help quantify the effect of persistent, rather than transitory, factors on total and services consumption. They

suggest that if the recovery after the financial crisis had been ruled by the high average growth regime, by the second quarter of 2014, total consumption would have been about \$1.1 trillion higher and services consumption would have been about \$1 trillion higher.

IV. Conclusion

In this article, we use a regime-switching model to show that slow growth in total and services consumption after the Great Recession was due not to transitory factors or fundamental changes in consumption behavior but to the unusual persistence of a low average growth regime during the recovery. Low average growth regimes typically reflect the influence of persistent factors such as a slow labor market recovery, restrictive financial conditions, or weak productivity growth. Thus, policies that eliminated or alleviated these headwinds might have helped strengthen growth, leading to significantly higher consumption in the recovery.

However, one caveat to our results is that by modeling consumption growth with a regime-switching framework, we have only captured consumption dynamics in a reduced form. Although our analysis shows consumption growth remained in the low average growth regime after the crisis, it does not explain why. An analysis of the economic fundamentals driving growth would better indicate why growth after the recession was slow and which policies could have affected it. In addition, this analysis has focused on consumption growth in isolation, and ignored possibly important spillover effects into other parts of the economy, such as investment and labor markets, which may further affect consumption growth.

Endnotes

¹This graphical analysis combines the “double dip” recessions of 1980 and 1981 with the peak occurring in 1980:Q1 and the trough in 1982:Q4.

²These shares vary over time, both in terms of a trend and over the business cycle. The shares reported here are based on recent data; in the 1950s and 1960s, for example, durables made up a smaller share of consumption (around 5 percent), and nondurables had a larger share (around 31 percent). The services share has remained relatively stable.

³The specification does not permit an autoregressive component to consumption growth, and therefore consumption follows a pure random walk with possibly time-varying drift. Taking account of persistence may be important for other measures of the business cycle (Davig), the dynamic responses of the macroeconomy to monetary policy shocks (Sims and Zha), or many other applications.

⁴Model selection for Markov-switching models can be problematic, since regularity conditions needed for likelihood ratio tests break down (Smith and others), and other information criteria such as Akaike’s Information Criterion tend to over-fit and select too many regimes (Fruhworth-Schnatter). The SBIC here provides a more accurate criterion and has been shown to be useful in larger structural models (Liu and others).

⁵Given the Markov transition probabilities, the expected duration of the low average growth regime is $1/(1 - P_{ll}^{\mu})$, and similar for the high average growth and both volatility regimes. Note that small differences in the probability of switching regimes can have relatively large differences in the regimes’ expected durations.

⁶This probability is “smoothed” in the sense that it is both backward and forward looking; in other words, the calculation for a given quarter uses information from data both before and after that quarter to infer the regime. This method contrasts with a backward-looking probability that would only use data up to the quarter in question.

References

- Davig, Troy. 2008. "Detecting Recessions in the Great Moderation: A Real-Time Analysis," Federal Reserve Bank of Kansas City, *Economic Review*, vol. 93, no. 4, pp. 5–33.
- Fruhwirth-Schnatter, Sylvia. 2006. *Finite Mixture and Markov Switching Models*. New York: Springer.
- Hamilton, James. 1989. "A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle," *Econometrica*, vol. 57, no. 2, pp. 357–384.
- Lettau, Martin, Sydney Ludvigson, and Jessica Wachter. 2008. "The Declining Equity Premium: What Role Does Macroeconomic Risk Play?" *Review of Financial Studies*, vol. 21, no. 4, pp. 1653–1687.
- Liu, Zheng, Daniel Waggoner, and Tao Zha. 2011. "Sources of Macroeconomic Fluctuations: A Regime-Switching DSGE Approach," *Quantitative Economics*, vol. 2, no. 2, pp. 251–301.
- Kim, Chang-Jin, and Charles Nelson. 1999. "Has the Economy Become More Stable? A Bayesian Approach Based on a Markov-Switching Model of the Business Cycle," *Review of Economics and Statistics*, vol. 81, no. 4, pp. 608–616.
- McConnell, Margaret, and Gabriel Perez-Quiros. 2000. "Output Fluctuations in the United States: What has Changed Since the Early 1980s?" *American Economic Review*, vol. 90, no. 5, pp. 1464–1476.
- Sims, Chris, and Tao Zha. 2006. "Were There Regime Switches in U.S. Monetary Policy?" *American Economic Review*, vol. 96, no. 1, pp. 54–81.