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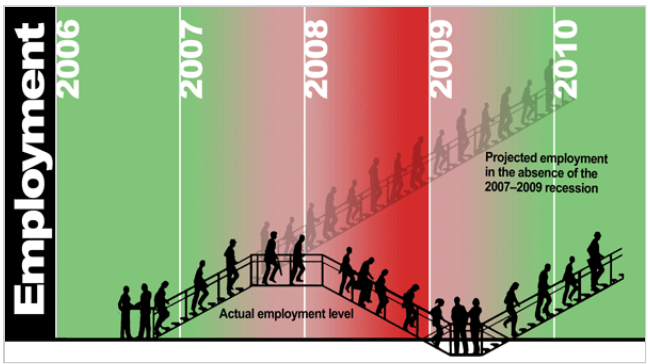
A cohort component analysis of the 2007–2009 recession

A model of employment change between 2007 and 2010 in the absence of the recession was compared with actual employment change as measured by the Current Population Survey. Not surprisingly, results show that actual employment was lower than the model predicted for all age groups; however, differences were much larger for younger workers. Full-time employment was much lower than the model predicted, while part-time employment was much higher. Actual employment change varied widely among occupation and industry groups, but nearly all groups had employment that was lower than the model predicted.



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The recession of 2007–2009 resulted in the loss of millions of jobs, although not all sectors of the economy were affected equally. Much has been written about the employment effects of the recession, with many reports focusing on the change in overall or specific sector employment over the course of the recession.[1] However, many of these analyses do not take into account how employment would have changed without the recession. This article uses a simple projection model to create a counterfactual scenario of where the economy would have been without the recession and compares the results of this model with actual employment changes to see the impact of the recession on total employment, full- and part-time workers, occupational employment, and industry employment.

Model specification and implementation

The cohort component method, which analyzes changes within age cohorts between two time periods, was used to construct a projection of what employment would have been if there had been no recession. The cohort component method is typically used for projecting population but can be used to estimate changes over time in any demographic or labor force characteristic. The advantage of the cohort component method over simply extrapolating from historical trends is that changes in age demographics can be taken into account, which gives

rise to more reliable results and more detail in the composition of results. For example, using the cohort component method allows for analysis of modeled versus actual change in employment levels for younger workers as compared with older workers.

The period 2004–2007 is used to represent a typical nonrecessionary period, and employment change is calculated for 5-year age cohorts over that period. These percent changes in employment from the 2004–2007 period were applied to cohorts with the identical age ranges in 2007—for instance, the percent change for 21-to-25-year olds in 2004–2007 was applied to people ages 21 to 25 during the 2007–2010 period—to come up with projected 2010 employment for each cohort using the following equation:

$$E_{(x+3:z+3),2010} = \left(\frac{E_{(x+3:z+3),2007}}{E_{x:z,2004}} \right) * E_{x:z,2007}$$

where $E_{x:z,y}$ is employment of cohort age range x through z in year y.

To implement this cohort component model, microdata from the Current Population Survey (CPS) for the years 2004 and 2007 were used to calculate employment for each cohort. Table 1 shows the total employment in each of the cohorts along with the percentage change in employment between the years 2004 and 2007. For example, employment of the cohort that was 21 to 25 years old in 2004 grew from about 14 million in 2004 to about 16 million in 2007, a growth rate of about 14 percent.

Table 1. Employment and percent change by age cohort, 2004 and 2007

2004		2007		Percent change, 2004–2007
Age	Employment (in thousands)	Age	Employment (in thousands)	
16–20	8,315	19–23	12,754	53.4
21–25	14,231	24–28	16,208	13.9
26–30	14,655	29–33	15,457	5.5
31–35	16,166	34–38	16,488	2.0
36–40	16,837	39–43	17,245	2.4
41–45	18,097	44–48	18,396	1.7
46–50	17,228	49–53	16,813	-2.4
51–55	14,158	54–58	13,366	-5.6
56–61	11,731	59–64	9,736	-17.0

Source: Current Population Survey.

The 2004–2007 growth rates for each cohort were then applied to 2007 CPS estimates of employment for the same initial age cohort to obtain a model estimate of 2010 employment. Table 2 shows the actual employment in 2007 along with the 2004–2007 growth rate derived from the cohort analysis of the same age group in 2004 (see table 1), as well as the modeled estimate of 2010 employment for each cohort. This model was implemented separately for each of the following: total employment (as shown in tables 2 and 3), full-time employment, part-time employment, employment by occupation groups, and employment by industry groups.

Table 2. Employment in 2007, percent change 2004–2007, and model-estimated employment in 2010, by age cohort

2007		Percent change, 2004–2007	2010	
Age	Employment (in thousands)		Age	Model-estimated employment (in thousands)
16–20	8,383	53.4	19–23	12,858
21–25	14,789	13.9	24–28	16,843
26–30	16,206	5.5	29–33	17,092
31–35	15,279	2.0	34–38	15,584
36–40	16,924	2.4	39–43	17,334
41–45	17,874	1.7	44–48	18,169
46–50	18,161	-2.4	49–53	17,723
51–55	15,489	-5.6	54–58	14,622
56–61	13,703	-17.0	59–64	11,373

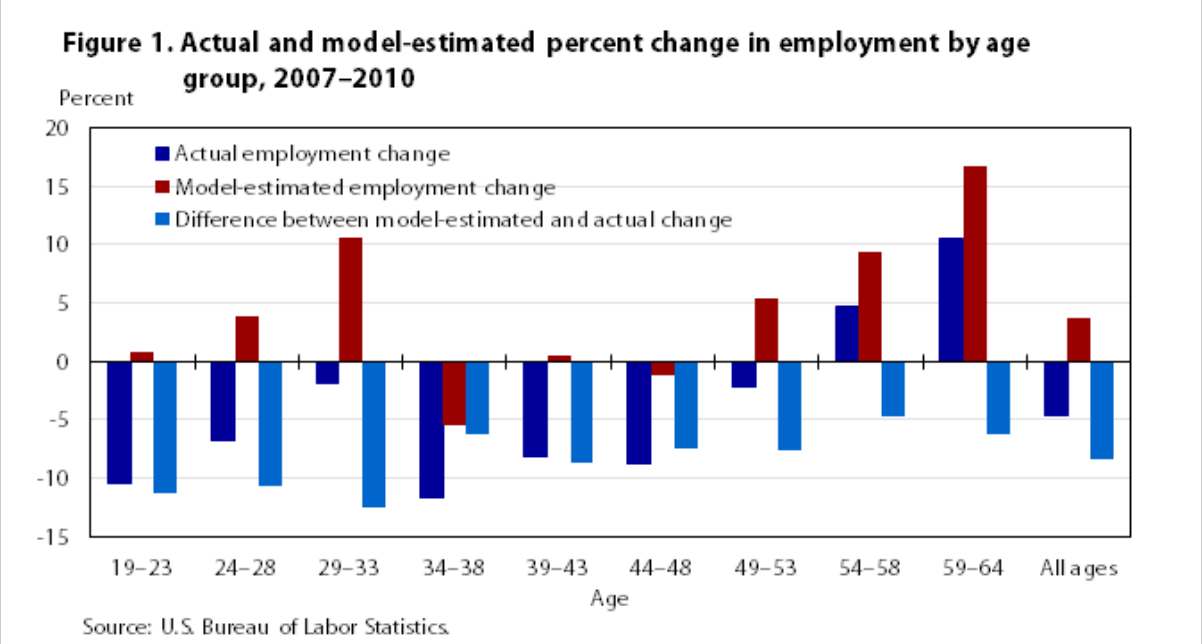
Source: Current Population Survey and authors' calculations.

Examining the effects of the recession. Model estimates of 2010 employment by age group were compared with actual survey employment from the CPS for the same age groups for each of the characteristics we examine. For instance, model-estimated employment of 24 to 28 year olds in 2010 was compared with survey-estimated employment of 24 to 28 year olds 2010. In addition, we compare the model-predicted estimates of 2010 employment and the survey estimates of 2010 employment with survey estimates of 2007 employment for the same age range to show how actual growth and decline compared with what the model predicted.

Modeled versus actual employment

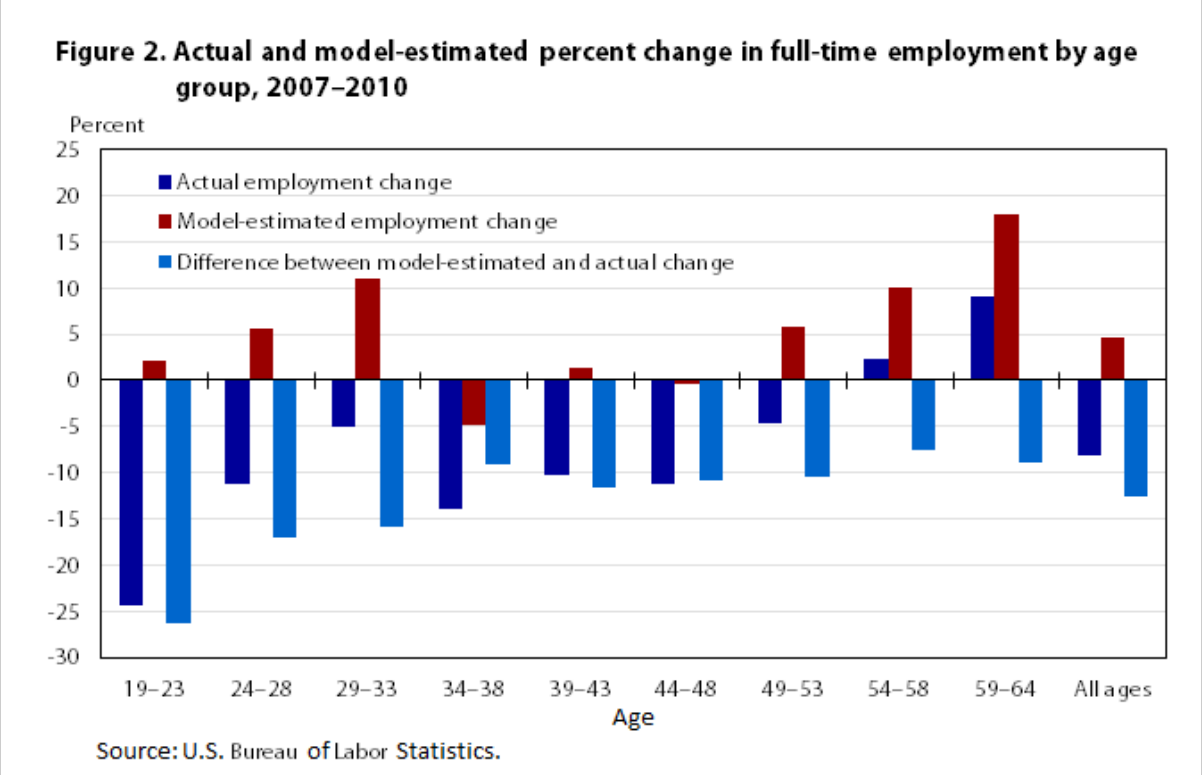
Projected employment levels that were estimated using the model differed from actual survey estimates in several ways, as discussed below.

Total employment. In 2007, employment of people ages 19 to 64 was approximately136.5 million. On the basis of the cohort analysis of historical data, employment for this age group was predicted to increase by 4 percent to 141.6 million in 2010 had historical trends continued. However, employment actually fell by 5 percent to 130.1 million in 2010, a level that is 11.5 million less than the model predicted. This difference comprises both actual declines in employment and modeled employment growth between 2007 and 2010 that was never realized.



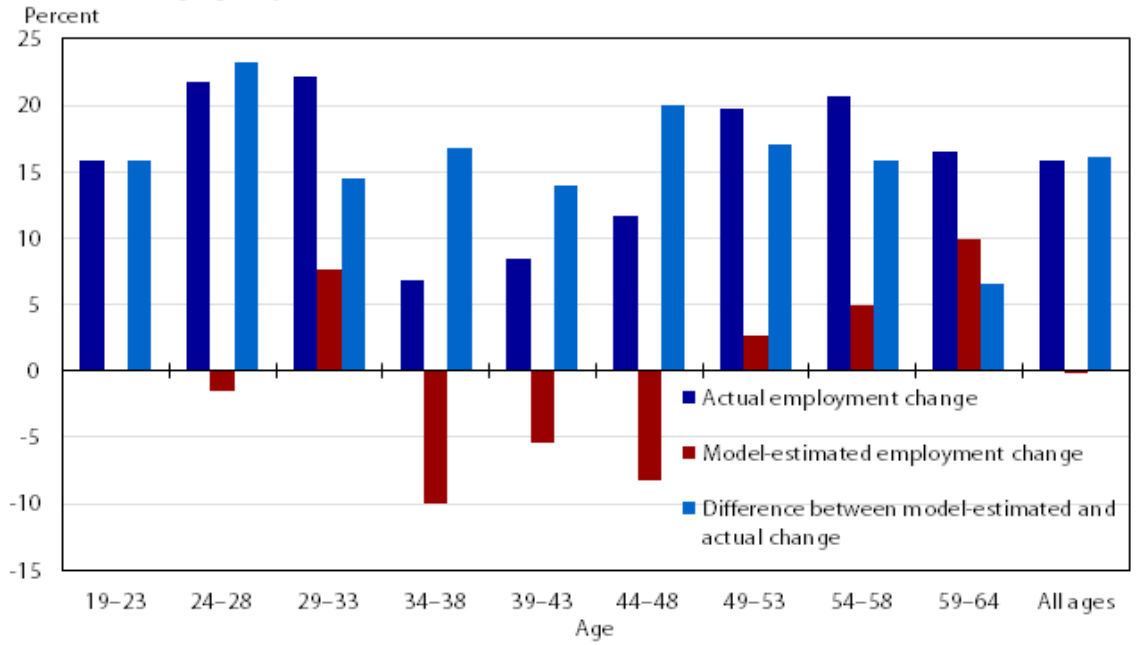
All age groups failed to reach their model-predicted employment growth between 2007 and 2010. Figure 1 shows the actual and model-predicted percentage change in employment between 2007 and 2010 for each age group that was analyzed. Only two age groups—workers ages 54 to 58 and ages 59 to 64—experienced employment growth. This growth is attributable to the movement of large numbers of baby boomers, generally considered to be people born between 1946 and 1964, into these age groups between 2007 and 2010. However, even though these older age groups experienced some employment growth, it was still well below the growth predicted by the cohort model; no age group was immune to the effects of the recession on employment.

When looking at the differences between actual and model-predicted percentage changes in employment for each age group, we found that younger workers fared worse than other age groups during the recession. The three age groups comprising workers between 19 and 33 years of age were the only age groups to have a difference of more than 10 percentage points between their actual and model-predicted percentage changes in employment between 2007 and 2010. Thus, even though workers ages 34 to 38 in 2010 experienced the largest absolute decline, younger workers ages 19 to 33 in 2010 were furthest from reaching their model-predicted level of employment.



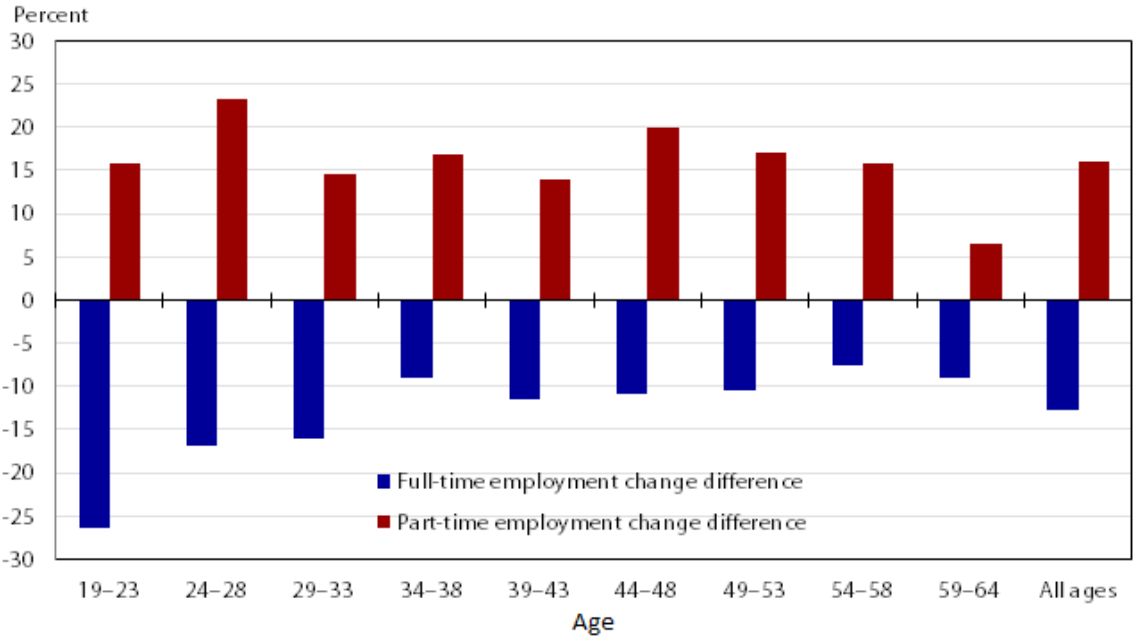
Full-time and part-time employment. The cohort model predicted that full-time employment would increase by 5 percent between 2007 and 2010 for workers ages 19 to 64, but employment actually declined by 8 percent, a 13 percentage-point difference between the actual and modeled growth (see figure 2). Mirroring patterns seen in total employment, full-time employment across all age groups was lower than the model predicted in 2010. However, the differences between actual and modeled changes in full-time employment were actually larger than the differences in total employment. This is because large declines in full-time employment were mitigated by growth in part-time employment between 2007 and 2010: on the basis of the cohort model, part-time employment was predicted to remain flat between 2007 and 2010 but actually grew by 16 percent (see figure 3). In all age groups, part-time employment grew between 2007 and 2010 and was higher than the model predicted, even as full-time employment was lower than the model predicted in each age group (see figure 4). Similar to total employment, the most dramatic differences in full-time employment between actual and model-predicted employments were among younger age groups, while older workers came closest to their modeled employment levels.

Figure 3. Actual and model-estimated percent change in part-time employment by age group, 2007–2010



Source: U.S. Bureau of Labor Statistics.

Figure 4. Comparison of part-time and full-time employment change relative to model-estimated change, 2007–2010



Source: U.S. Bureau of Labor Statistics.

The widest differences between actual and model-predicted changes in full-time employment were among younger workers. Full-time employment of workers ages 19 to 33 were between 16 and 26 percentage points less than what the cohort model predicted in 2010. The largest difference was for workers ages 19 to 23, who had a difference of 26 percentage points between their actual and modeled levels of employment, consisting of a 24 percent decline in actual employment and lost potential growth of 2 percent. Offsetting these declines were larger

increases in part-time employment among younger workers than the model predicted. For example, part-time employment was 16 percentage points higher than the model predicted for workers ages 19 to 23 and 23 percentage points higher for workers ages 24 to 28, the largest difference for any age group. Though large, these gains in part-time employment for workers ages 19 to 33 were not enough to overcome the declines in full-time employment, which led to declines in total employment that were 11 to 13 percentage points larger than the model predicted.

Differences between actual and model-predicted changes in full-time employment were not as dramatic for older age groups as for younger age groups, although the directions of these changes were the same. For example, employment of full-time workers ages 34 to 64 years of age was between 8 and 12 percentage points less than the model predicted in 2010, compared with a range of 17 to 26 percentage points less for workers ages 19 to 33. However, the differences between actual and model-predicted changes in part-time employment show no discernable pattern based on age, with employment of all age groups higher than the model predicted in 2010 (see figure 4).

Occupational employment. Employment by occupation was analyzed for five occupational groups by comparing the actual employment change of 19 to 64 year olds and the employment change predicted by the cohort model (see table 3).

Table 3. Actual and model-estimated employment change by occupational group, 2007–2010

Occupational group	Actual percent change, 2007–2010	Model-estimated percent change, 2007–2010	Percentage point difference between actual and projected change
Management, business, science, and arts occupations	-1	6	-7
Service occupations	4	5	-1
Sales and office occupations	-7	1	-8
Natural resources, construction, and maintenance occupations	-17	7	-24
Production, transportation, and material moving occupations	-11	0	-11

Source: Current Population Survey and authors' calculations.

Natural resources, construction, and maintenance occupations experienced the largest actual employment decline between 2007 and 2010 at 17 percent, which coincides with the collapse of the housing bubble during this time. The cohort model predicted that this occupational group would have the largest growth, 7 percent, which was also a consequence of the inflated growth produced by the housing bubble. The large increase predicted by the model and the large decline in actual employment caused this occupational group to have a 24-percentage-point difference between the actual and modeled employment change, the largest such change.

The 11-percent employment decline in production, transportation, and material moving occupations was the second largest decline in actual employment. Nearly half of this occupational group is employed in the manufacturing industry, which was hit particularly hard by the recession. The model predicted that employment would remain stable

Management, business, science, and arts occupations, as well as sales and office occupations, experienced differences between actual and modeled employment of 7 and 8 percentage points, respectively. This is similar to the 8-percentage-point difference experienced by the economy as a whole. However, for management, business, science, and arts occupations, the difference stemmed from lost potential growth as employment only declined by 1 percent, whereas sales and office occupations actually experienced a 7-percent decline and only lost 1 percentage point in potential growth.

Service occupations were the only group to experience employment growth from 2007 to 2010; service occupations employment grew by 4 percent. This group was least affected by the recession, as the growth of employment in service occupations only lagged modeled growth by 1 percentage point. This could be due to these workers largely being employed in recession-proof industries, such as education and healthcare.

Industry employment. Employment by industry was analyzed for five industry groups[2] by comparing the actual employment change of 19 to 64 year olds and the predicted employment change from the cohort model between 2007 and 2010 (see table 4).

Table 4. Actual and model-estimated employment change by industry group, 2007–2010

Industry group	Actual percent change, 2007–2010	Model-estimated percent change, 2007–2010	Difference between actual and projected percent change
Agriculture	5	-5	10
Goods production	-18	3	-21
Government	0	4	-3
Health care and educational services	4	5	-1
Services, excluding health care and education	-4	4	-8

Note: Difference may not sum correctly because of rounding.

Source: Current Population Survey and authors' calculations.

The widest gap between actual and modeled levels of employment growth occurred in goods-producing industries. The model-predicted employment in goods-producing industries such as construction and manufacturing would increase by 3 percent between 2007 and 2010, but employment actually decreased by 18 percent, a difference of 21 percentage points. These declines were largely due to the collapse of the housing bubble and the negative impact the recession had on manufacturing. These results coincide with the occupational analysis that showed occupations heavily concentrated in these industries, such as construction and extraction occupations and production occupations, had the largest differences between actual and model-predicted employment.

The smallest differences between model-predicted and actual employment growth occurred in the government and the health care and education sectors. Employment in government was unchanged between 2007 and 2010 compared with a modeled growth rate of 4 percent. The difference between actual and modeled growth was even smaller for the health care and education industry sector, where employment grew by 4 percent, only 1 percentage point less than the model predicted. These industries are often considered to be recession proof because the

services they provide are thought of as essential and are not subject to the same changes in demand that recessions cause in other industries.

The model-predicted employment in service-providing industries excluding health care and education would grow by 4 percent, but employment actually declined by 4 percent, a difference of 8 percentage points between the actual and modeled employment change. Unlike health care and education, the service-providing industries in this sector are more susceptible to changes in the business cycle. For example, retail trade experienced losses during the recession that were due to declines in consumer spending. Additionally, the collapse of the housing bubble and the tightening of credit markets had a severe impact on the financial services and real estate industries.

IN SUMMARY, while the recession negatively affected employment levels for all age groups and for most occupations and industries, younger workers and full-time workers, as well as jobs related to construction and manufacturing, were affected more sharply than predicted by the cohort-based model.

SUGGESTED CITATION

Brian Roberts and Dalton Terrell, "A cohort component analysis of the 2007–2009 recession," *Monthly Labor Review,* U.S. Bureau of Labor Statistics, March 2014, https://doi.org/10.21916/mlr.2014.8

NOTES

1 For example, see “The Recession of 2007–2009,” *BLS Spotlight on Statistics*, February 2012, https://www.bls.gov/spotlight/2012/recession/pdf/recession_bls_spotlight.pdf and Christopher J. Goodman and Steven M. Mance, “Employment loss and the 2007–2009 recession: an overview,” *Monthly Labor Review*, April 2011, pp. 3–12, https://www.bls.gov/opub/mlr/2011/04/art1full.pdf.

2 The five industry groups are private agriculture; private goods production; private services excluding health care and educational services; health care and public and private educational services; and government excluding health care and educational services. These industry groups use NAICS sectors grouped together to provide larger sample sizes.

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