Chicago Fed Letter

Wage growth, inflation, and the labor share

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The recent pattern of nominal wage growth has been a puzzle to economists, researchers, and policymakers because it lies well below the trend wage growth predicted by inflation and productivity growth. We show that the difference can be reconciled by accounting for the labor share of output, which has been on a declining trend for the past 15 years.

Wage growth remains low, despite general improvements in the labor market since the most recent recession. From 2010:Q4 through 2015:Q1, nominal wage growth in the nonfarm business sector averaged 2.1% per year, up only slightly from average annual growth of 1.9% from 2007:Q4 through 2010:Q4.

Between 2010:Q4 and 2015:Q1, trend productivity averaged 1.4% per year and the Fed inflation target was 2%, leading many to wonder why nominal wage growth was not closer to 3.4% over this period. Even if one took into account the low rate of actual inflation over this period, it would suggest that nominal wage growth should be closer to 2.9%. If wage growth is a signal of future inflation, then understanding the factors contributing to the shortfall in wage growth is important for informing monetary policy.

In this *Chicago Fed Letter*, we use the definition of the labor share of output to decompose the wage growth gap—the difference between actual nominal wage growth and trend wage growth—into its component parts.[1] The labor share (compensation as a fraction of business revenue) had been relatively constant for many years, suggesting that policymakers could essentially ignore it when thinking about the wage–inflation relationship. Starting in 2001, however, labor share began a fairly steady decline, meaning that it could no longer be ignored when one estimates trend wage growth. Our decomposition shows that accounting for the decline in trend labor share can explain nearly the entire gap between observed nominal wage growth and the growth predicted by trend productivity growth and inflation.

Framework for thinking about wage growth

A firm's labor share represents the total compensation paid to workers as a fraction of total revenue. Total worker compensation is average hourly earnings (which include wages, salaries, and benefits in the data, although we will refer to it as the "wage" for simplicity) multiplied by total hours worked by all employees. Total revenue (or value added) is the average price received from sales multiplied by total output. Therefore, one can express the labor share as follows:

$$\text{labor share} = \frac{\text{wage} \times \text{hours}}{\text{price} \times \text{output}}.$$

1. Quarterly nominal wage growth, actual and trend

y/y percent change

— Nominal wage growth (actual)
— Trend nominal wage growth
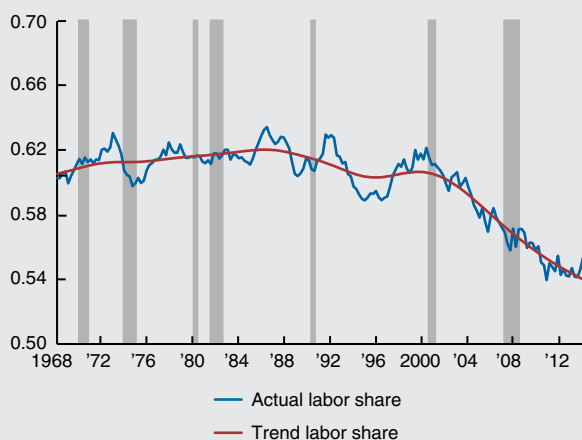- - - Trend productivity growth + inflation

NOTE: The shaded areas represent recessions as classified by the National Bureau of Economic Research.

SOURCES: Authors' calculations using nonfarm business compensation and output per hour from the U.S. Bureau of Labor Statistics, core PCE (personal consumption expenditures) inflation from the U.S. Bureau of Economic Analysis, ten-year expected inflation from the *Survey of Professional Forecasters*, and labor share estimates from the Board of Governors of the Federal Reserve System.

2. Labor share, actual and trend

share of labor output

Legend:
— Actual labor share
— Trend labor share

The equation holds for both individual firms and for the aggregate economy. One can rearrange the terms in this equation to show that the wage is equal to the product of the labor share, labor productivity (i.e., output per hour), and the output price,

$$\text{wage} = \text{labor share} \times \left(\frac{\text{output}}{\text{hour}}\right) \times \text{price}.$$

As a result, one can express wage *growth* as the sum of the growth rates of its three components. For the aggregate economy, this implies that (aggregate) nominal wage growth can be expressed as the sum of the growth in the aggregate labor share, labor productivity growth, and the inflation rate (i.e., price growth).

Similarly, the trend of nominal wage growth can be expressed as the sum of the trend growth in labor share, trend labor productivity growth, and the trend inflation rate.

We are interested in the nominal wage growth *gap* in order to understand which factors are contributing to the currently low rate of wage growth. The wage growth gap is the difference between the nominal wage growth observed in the data and trend wage growth. It can be represented as the sum of the gaps for its component parts, i.e., differences between observed and trend values for labor share growth, labor productivity growth, and inflation. If one of the component

gaps is positive, it contributes to driving nominal wage growth above its trend; and if one of the component gaps is negative, it contributes to driving nominal wage growth below its trend.

We apply these definitions and relationships to the data using nonfarm business compensation to measure wage growth, real nonfarm business output per hour to measure labor productivity growth, and the price index of personal consumption expenditures, excluding food and energy (i.e., "core" PCE) to measure inflation. Our measures of labor share, both actual and trend, come from the Board of Governors of the Federal Reserve System. The Board of Governors estimates trend labor share by applying a filter to measures of real compensation per hour and labor productivity in a way that is consistent with our labor share equation above. We use a measure of trend labor productivity estimated by the Chicago Fed staff along with earlier forecasts from the Congressional Budget Office (CBO). We use the *Survey of Professional Forecasters'* (SPF)[2] ten-year ahead forecast to measure trend inflation. Our measure of trend nominal wage growth is simply the sum of the trend growth rates of its three components.

Because the measures come from four different data sources, actual nominal wage growth need not equal the sum of its component growth rates. Therefore, the nominal wage growth gap will be the sum of the labor share growth gap, the labor productivity growth gap, and the inflation gap plus a measurement "residual."[3]

A look at the data

In figure 1, we present quarterly nominal wage growth from 1968:Q1 through 2015:Q1, along with the sum of trend productivity growth plus trend inflation. This sum is what policymakers have typically used as a measure of trend nominal wage growth, since trend labor share has historically shown little change. During the 1970s, this estimate of trend nominal wage growth was below actual nominal wage growth, while during the 1980s and early 1990s it was above actual nominal wage growth. At the onset of the Great Recession, observed nominal wage growth fell much more than the traditional measure of trend nominal wage growth.

Figure 1 also plots trend nominal wage growth based on our decomposition described earlier, which accounts for changes in labor share. The figure shows that measured either way, trend nominal wage growth had essentially the same pattern until about 2001. From then on, accounting for labor share became important as it led to a notably lower estimate of trend nominal wage growth.
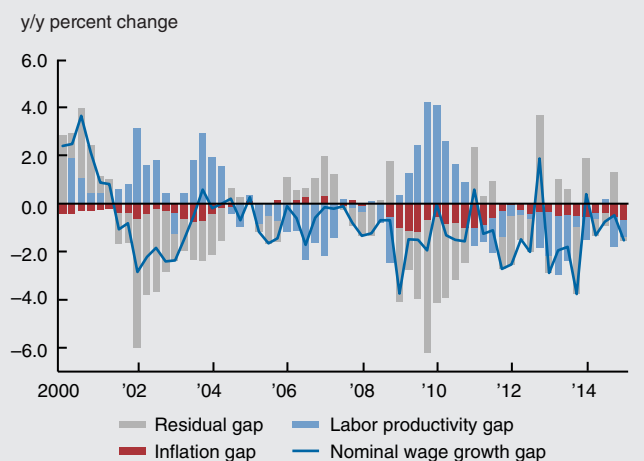
Figure 2 shows why this is the case. It plots actual and trend labor share. The

3. Components of actual and trend nominal wage growth

Period	Real output per hour	CBO/ Chicago Fed trend labor productivity growth	Core PCE inflation	Trend PCE inflation	Growth in labor share	Growth in trend labor share
1981:Q3– 1990:Q3	1.65	1.68	4.43	5.24	–0.12	–0.01
1990:Q3– 2001:Q1	2.15	2.27	2.21	2.79	0.15	–0.15
2001:Q1– 2007:Q4	2.61	2.47	1.90	2.09	–0.83	–0.73
2007:Q4– 2010:Q4	2.37	1.26	1.55	2.15	–1.42	–0.99
2010:Q4– 2015:Q1	0.53	1.36	1.55	2.08	–0.06	–0.78

4. Decomposition of nominal wage growth gap, ignoring labor share

y/y percent change

SOURCES: Authors' calculations using nonfarm business compensation and output per hour from the U.S. Bureau of Labor Statistics, core PCE (personal consumption expenditures) inflation from the U.S. Bureau of Economic Analysis, and ten-year expected inflation from the *Survey of Professional Forecasters*.

5. Decomposition of nominal wage growth gap, accounting for labor share
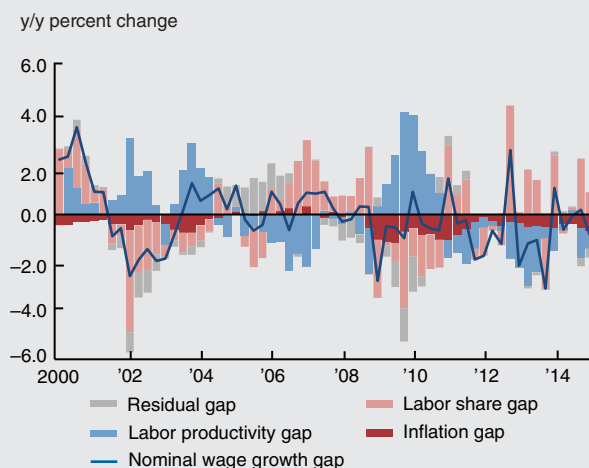
y/y percent change

SOURCES: Authors' calculations using nonfarm business compensation and output per hour from the U.S. Bureau of Labor Statistics, core PCE (personal consumption expenditures) inflation from the U.S. Bureau of Economic Analysis, ten-year expected inflation from the *Survey of Professional Forecasters*, and labor share estimates from the Board of Governors of the Federal Reserve System.

figure shows the clear and steady decline in labor share that began around 2001. As a result, we see a widening difference between the trend nominal wage growth that accounts for the decline in labor share and the sum of trend labor productivity plus trend inflation in figure 1. Thus, while nominal wage growth is relatively low by historical standards, trend wage growth is low as well, particularly once we account for the decline in labor share.

Figure 3 presents averages over various periods for the components of nominal and trend wage growth—labor productivity growth, core PCE inflation, and labor share growth. Trend labor productivity growth declined considerably from 2007:Q4 onward, while trend inflation remained roughly constant at 2.1%. From 2007:Q4 to 2010:Q4, trend growth in labor share was –0.99%; and from 2010:Q4 through 2015:Q1, it was –0.78%. Trend growth in labor share was essentially negligible before 2001, averaging –0.01% from 1981:Q3 through 1990:Q3 and –0.15% from 1990:Q3 through 2001:Q1.

Decomposing nominal wage growth

As we discussed earlier, one can decompose the gap between actual and trend nominal wage growth into the gaps of its component parts. Figure 4 plots this decomposition from 2000:Q1 through 2015:Q1 for the case where we ignore changes in labor share. The quarterly nominal wage growth gap is represented by the line, while the bars represent the contribution of component gaps. A bar greater than zero increases the wage growth gap, and a bar less than zero decreases the wage growth gap. Over much of this period, the wage growth gap is negative, meaning that trend nominal wage growth (assuming no change in labor share) exceeds observed nominal wage growth. The gap is most negative during the economic downturns (2001–03 and 2008–12), both of which experienced weak labor markets well after the official end of each recession. From 2010:Q4 through 2015:Q1, the nominal wage growth gap averaged –1.34 percentage points, with roughly 60% due to below-trend growth in labor productivity and the remainder due to below-trend growth in inflation. The residual, which includes changes in labor share in this decomposition, contributes only 0.09 percentage points to the reduction in the wage growth gap over this period. In 2015:Q1, the wage growth gap was –1.53%, with roughly equal shares attributable to the labor productivity gap and the inflation gap. Over the whole period, the residual averages a contribution of –0.56 percentage points to the wage growth gap, but this masks the fact that the residual has large

negative contributions during the recession periods and modestly positive contributions during the 2004–07 expansion period.

In figure 5, we present the same decomposition, this time explicitly accounting for a labor share gap. When we account for changes in labor share, the nominal wage growth gap averages

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only –0.56 percentage points between 2010:Q4 and 2015:Q1, a reduction of 58% from the gap estimated using the previous decomposition. Furthermore, the gap is smaller (in absolute value) than the sum of the average inflation gap of –0.53 percentage points and the average labor productivity gap of –0.83 percentage points. The difference is almost entirely accounted for by the positive average labor share gap of 0.72 percentage points. Trend labor share continued to fall during this period, as figure 2 shows, but actual labor share fell by less. This led to a smaller wage growth gap than was predicted by inflation and labor productivity alone. The contribution is consistent with the behavior of the labor share gap since 2000—it contributes positively to the wage growth gap during expansions and negatively to the gap during downturns.

Conclusion

We find that accounting for changes in the labor share of output, both observed changes and changes in its trend, is important for measuring whether, and by how much, nominal wage growth is below its trend value. We find that wages have been growing below their estimated trend over the 2010–15 period, but not nearly as much as ignoring labor share would suggest. Accounting for above-trend growth in labor share over this period suggests that this gap averaged –0.56 percentage points, while ignoring the declining labor share trend suggests that the gap was –1.34 percentage points. The smaller gap implies that there is considerably more nominal wage pressure, and consequently less slack, in the labor market than an analysis that ignores labor share would suggest.

[1] In this *Chicago Fed Letter*, "trend" refers to the value a variable would have in the absence of the business cycle.

[2] See https://www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/.

[3] More precisely, trend nominal wage growth is measured as the sum of its component trends, but actual nominal wage growth is instead measured directly from the data. As a result, part of the nominal wage growth gap will be due to measurement differences across the data sets used to estimate trend wage growth. The residual refers to this component.