The Link Between Wages and Productivity Is Strong

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ABSTRACT

Much of the public debate in recent years suggests that wages are not primarily determined by productivity. Indeed, the argument that the link between compensation and productivity has been effectively severed is commonly made. In this paper, I first discuss the wage-setting process and the conceptual issues that are of critical importance to any empirical investigation of the link between compensation and productivity. I then highlight some recent evidence suggesting that, contrary to the current narrative in some policy circles, the link between productivity and wages is strong.

1. How Should We Think About Wages?

Adam Smith's invisible hand is alive and well in the textbook understanding of wages.

Workers—who need jobs in order to generate earnings to purchase goods and services—enter the labor market willing to supply their labor in exchange for a wage above which (or equal to) the rate at which they are indifferent between working and not working.

Employers enter the labor market because they need workers to produce goods and services. Assuming the labor market is "competitive," firms take the market wage as a given, operating under the assumption that they cannot influence it. They hire workers up to the point at which the additional revenue generated by hiring an additional worker is equal to the wage rate (i.e., the additional cost of employing that worker).

In this simple model, the higher the wage, the greater the number of workers who want to work; the lower the wage, the greater the number of workers firms want to hire. The labor market reconciles these conflicting wants by settling at an "equilibrium" wage rate—a wage rate such that everyone who wants to work (at the equilibrium wage) finds a job, and every firm that wants to hire workers (again, at the equilibrium wage) finds all the workers it wants. At the equilibrium wage, the labor market clears: labor supply (the number of workers who want to work) equals labor demand (the number of workers firms want to hire). A wage rate above the equilibrium wage would result in too many workers seeking too few jobs; a wage rate below would result in the opposite.

Let's pause here and note that this is a *model* of how labor markets work. In reality, the labor market for an industry or a geographic area—to say nothing of the U.S. labor market as a whole—likely never reaches equilibrium.

Why not? Wages may be "sticky," in the sense that firms are reluctant to reduce workers' nominal pay when market conditions change. (Economists refer to this as "downward

nominal wage rigidity.") Minimum wages and other labor market regulations may interfere with the ability of the labor market to adjust wages to the market clearing point where labor supply and demand are equal. International trade and technological advances may frequently change the demand for some types of workers, inhibiting a stable equilibrium from holding. These are just a few of many reasons.

Another crucial way the simple textbook model abstracts from reality is by assuming that firms typically face a market wage that they must take as given. In actual labor markets, firms often have some control over the wages they offer to their workers—labor markets deviate from the "perfectly competitive" standard textbook treatment. For example, firms in some locations and industries may have to increase their wage offering in order to attract additional workers. (This is an implication of the traditional understanding of "monopsony power" in the labor market.) These firms might be seeking workers who have a hard time changing jobs, such that higher wages are required to induce mobility. Firms that have a hard time monitoring their workers might pay higher wages in order to increase the costs workers face from slacking off and potentially losing a relatively well-paying job. Or firms might pay a higher wage to workers in order to increase their productivity and reduce turnover and the costs associated with it. (Implications of "efficiency wage" theory.) Businesses with monopoly power, meanwhile, face less incentive to hold down costs and may pay higher wages as a result.

Importantly, wages in many firms are also in part the result of a bargaining process between firms and workers. If firms have increasing bargaining power, then they will be able to push worker wages to the lowest wage workers will accept.

Even given these real-world considerations, the textbook model is extremely useful because it highlights the central role productivity plays in wage offerings. Intuitively, this link should be strong: If a worker can only produce, say, $15 per hour of revenue for his employer, then why would his employer pay him more than $15 per hour? And if a worker generates $15 per hour in revenue, then why would she accept a wage less than $15 per hour? The relationship between productivity and wages—wages equal "marginal revenue product"—also has attractive moral properties. If the relationship is strong, then workers are being paid, in a sense, "what they are worth" to the firm.

In my view, it is most useful to think of wages as being determined by a combination of competitive market forces, bargaining power, and institutions. Worker productivity is the baseline for which wages are determined. But unlike in the simple textbook model, the baseline is not the end of the story. Deviations from the baseline occur for a variety of reasons, several of which I discussed above.[1]

1 For a more formal discussion, see Clemens and Strain (2017).

In what follows, I will highlight some recent evidence suggesting that the link between productivity and wages is strong. This short paper is not intended to present a comprehensive summary of the economics literature, or to be a comprehensive discussion of wage determination. Instead, the evidence I discuss is illustrative and is intended to provide a framework for thinking about the wage-setting process, and how that process has evolved over time.

2. Conceptual Issues

In this section, I will discuss some of the conceptual issues that are of critical importance to any empirical investigation of the link between wages and productivity.

MEASURING WORKER PAY: WHICH WORKERS?

The strength of the link between productivity and wages is more complicated than it appears at first glance, in part because there are several sensible ways to define wages, and it is not clear which is best. Specifically, one must decide *whose* wages are of interest.

A natural answer here is the typical worker. To study whether the typical worker's pay is strongly related to productivity, the median wage of all workers is a good measure to use. Half of workers earn above the median and half earn below, making the median wage a good measure for middle-income (and, arguably, middle-class) wages.

Another measure of the typical worker's pay that's often used is the average wage for production and non-supervisory employees. This group of workers, which constitutes about 80% of the private-sector workforce, can roughly be thought of as workers, not managers. The Bureau of Labor Statistics defines this group as "production and related employees in manufacturing and mining and logging, construction workers in construction, and non-supervisory employees in private service-providing industries" (U.S. Department of Labor, 2018).

Economists Josh Bivens and Larry Mishel—who don't share my view on the strength of the link between productivity and wages—provide a reasonable argument for focusing on production and non-supervisory employees when thinking about the relationship between wages and productivity. They argue that researchers' focus should be on the strength of the relationship for "*most* American workers," and that "a key part of the growing gap between typical workers' pay and productivity is precisely the huge increases in salaries for highly paid managers and CEOs" (Bivens and Mishel, 2015). Therefore, they argue, managers should be excluded when investigating the relationship.

In addition to the typical worker's wages, it is also of interest to study the relationship between productivity and the average wage of all workers in the economy. The logic here is straightforward: If you are using economy-wide productivity to study the relationship between productivity and wages, then you should use economy-wide wages as well. While it is true that wages have been growing relatively faster for high-wage workers over the past several decades, it may also be true that the productivity of those workers has been growing relatively faster. Excluding them from the analysis may leave a key piece of the puzzle missing.

In addition, if the underlying reason for interest in the relationship between productivity and wages is not to see how workers' standards of living have evolved with productivity, but instead to study how firms compensate workers in their role as a key input to production, then it's desirable to study the average wage of all workers, not just of production and non-supervisory workers.

MEASURING WORKER PAY: CONVERTING NOMINAL WAGES TO INFLATION-ADJUSTED WAGES

The conceptual distinction between payments to workers as a factor of production and payments to workers as a measure of their standard of living also plays a critical role in deciding which measure of inflation should be used to convert nominal wages into real wages. When interested in the former, it is sensible to use a measure of producer prices because that captures the costs facing employers. When interested in the latter, a measure of consumer prices is reasonable because the prices consumers face are most relevant to their standards of living.

But when investigating the relationship between wages and productivity, a strong case can be made that wages should be deflated using a measure of the change in the prices of goods and services produced by businesses, not those consumed by workers. Economic theory predicts that workers are paid according to the marginal product of what they produce, not what they consume. Thus, an output price deflator is most appropriate.

MEASURING WORKER PAY: WAGES OR TOTAL COMPENSATION?

When determining whether higher productivity is translating into higher pay for workers, it is important to look at more than just real cash wages. For the "typical" worker—both the median worker and the average production and non-supervisory worker—and for all workers, non-wage compensation, including health benefits, is a large portion of total compensation. Indeed, non-wage compensation has risen as a share of total compensation from around 14% in the 1970s to around 19% today (Bureau of Economic Analysis, n.d.a.; Bureau of Economic Analysis, n.d.b.). In addition

to benefits, performance pay such as bonuses should be included in compensation. Arguably, stock options should be included as well, as those constitute a significant component of total compensation for some of the economy's highest-compensated workers.

MEASURING PRODUCTIVITY: NET OUTPUT OR GROSS OUTPUT?

Productivity can be defined as the amount of goods and services (output) produced in the economy for every unit of labor. For example, output per worker and output per hour of work are both productivity measures. Gross output includes capital depreciation, while net output does not. Since depreciation is not a source of income, net output is the better measure to use when investigating the link between worker compensation and productivity.

3. Direct Evidence on the Link Between Pay and Productivity

In a recent working paper, economists Anna M. Stansbury and Lawrence H. Summers (2017) address the link between pay and productivity. To my knowledge, their paper is the most recent to directly address this question. They use fluctuations in productivity growth over time to study how changes in productivity growth affect (or do not affect) wage growth.

Their paper is very thoughtful and carefully done. They study compensation of typical workers, using both the median wage and the average wage of production and non-supervisory employees, as well as the average wage of all workers. They deflate their compensation series using a consumer price measure rather than an output price measure, which I advised against above but which does increase the degree to which their results relate to the standard of living enjoyed by workers.[2] They use net domestic product per hour of work for their productivity measure.

Their empirical strategy is relatively straightforward. They calculate the three-year moving average of the change in (the log of) inflation-adjusted compensation for each group of workers and the three-year moving average of the change in (the log of) labor productivity. In this way, their measures of compensation and productivity can be thought of as measures of smooth, short-run compensation and productivity growth.

They then simply regress the compensation growth measure on the productivity growth measure, controlling for measures of the unemployment rate in order to make

2 In their paper, Stansbury and Summers report that using an output price deflator produces little change in their results.

sure that business cycle effects aren't distorting their estimates of the underlying relationship between productivity and compensation. Their main results use data from 1975 through 2015.

For median compensation, they find that a one percentage point increase in the growth rate of productivity is associated with a 0.73 percentage point increase in the growth rate of compensation. Importantly, they find that their estimate is "strongly statistically different" from zero—i.e., from no relationship between productivity and compensation—but not statistically significantly different from one. In other words, they cannot reject the hypothesis that productivity growth maps to compensation growth one-for-one, but they can reject the hypothesis that there is no relationship between the two.

When studying compensation for production and non-supervisory workers, Stansbury and Summers find that a one percentage point increase in the growth rate of productivity is associated with a 0.53 percentage point increase in the growth rate of compensation. The relationship for these workers is weaker than for median compensation, and their estimate is statistically significantly different from both zero and one.

For average compensation, they find that a one percentage point increase in the growth rate of productivity is associated with a 0.74 percentage point increase in the growth rate of compensation. As with median compensation, their estimate is statistically significantly different from zero, but not from one.

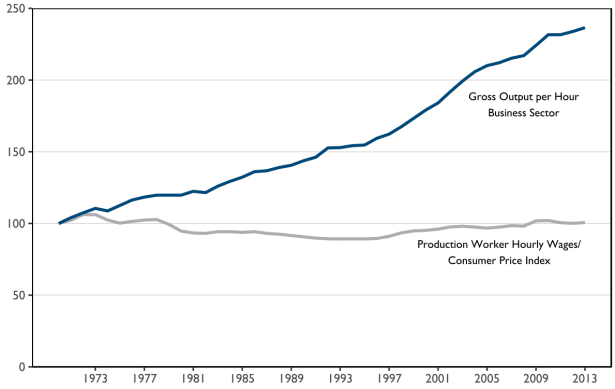
They conclude that "productivity growth still matters substantially for middle income Americans," and argue that "the substantial variations in productivity growth that have taken place in recent decades have been associated with substantial changes in median and mean real compensation." They take as given that compensation for typical workers has been stagnant over the past several decades, and reconcile their results with this by concluding that "other factors are suppressing typical workers' incomes even as productivity growth acts to increase them."[3]

4. Wages and Productivity Over Time

The conclusion from the Stansbury and Summers (2017) paper might be surprising given the public debate around the relationship between compensation and productivity, much of which suggests the link has been severed. This impression has been generated in part by charts that look like the following (Lawrence, 2016).

3 Stansbury and Summers estimate other models to confirm the robustness of their results. They also estimate models on data from decades prior to those discussed above, and separately for the period since 2000. In addition, they investigate whether technological progress has created a divergence between productivity and compensation. My brief treatment here has omitted discussion of many interesting components of their paper. I encourage those who are interested to read their entire paper.

Hourly Wages and Output per Hour, 1970-2013



Source: Lawrence (2016); U.S. Bureau of Economic Analysis; U.S. Bureau of Labor Statistics

Note: 1970=100

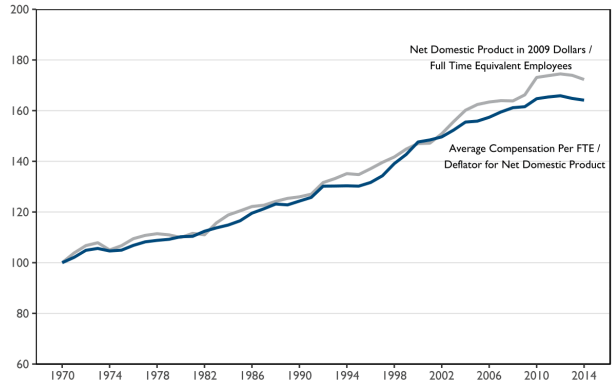
This chart, created by the economist Robert Lawrence, shows wages and productivity over time when the former is defined as the wages of production and non-supervisory employees, deflated by the consumer price index, and the latter is defined as gross output per hour in the business sector. The takeaway is clear: productivity has grown quite a bit, while wages have stagnated for decades. More specifically, the chart shows that productivity grew by 124% from 1970 to 2012, while wages during this time period increased by 26 cents (in 1982-84 dollars). This chart ignores the important conceptual issues discussed in Section 2 of this paper.

Lawrence then makes the following adjustments to the calculations that produced the chart above: (1) He uses output from the total economy, rather than just the business sector. (2) He uses net output (which removes capital depreciation), rather than gross output. (3) He includes both full- and part-time workers. Taken together, Lawrence finds that measuring productivity as the ratio of net total economy output divided by full-time equivalent employment reduces the 2013 gap in the chart by 20%.

Lawrence also considers a number of adjustments to the compensation calculation in the chart above. He finds that using compensation rather than wages reduces the 2013 gap in the chart by 8.2%. By including workers in managerial and professional positions, and by using a more inclusive measure of earnings, Lawrence explains 30% of the 2013 gap in the chart. By deflating wages using an output price index, Lawrence explains 35% of the gap. After those adjustments, the chart looks as follows.[4]

4 In his chapter, Lawrence also discussed differential compensation growth for workers in different parts of the wage distribution, and how these differences have contributed to growing inequality. He notes that many explanations for growing inequality are consistent with a strong link between productivity and compensation. He also discusses international trade, arguing that average wage differences between nations move in line with productivity. I encourage those who are interested to read his entire chapter.

Net Domestic Product and Real Product Compensation per Full-Time Equivalent Employee



Source: Lawrence (2016); Bureau of Economic Analysis National Income Accounts.

Note: 1970=100

In the chart above, productivity growth and compensation growth were coincident between 1970 and 2001. The chart depicts a divergence since 2001, especially since the Great Recession, but not a dramatic one.

The takeaway from this chart is clear: When properly measured, with variable definitions based on the most appropriate understanding of the relevant underlying economic concepts, trends in compensation and productivity have been very similar over the past several decades. Of course, it is also the case that two variables can evolve similarly over time without necessarily being related. But this chart, combined with the statistical evidence in the Stansbury and Summers paper and economic theory, provides compelling evidence that productivity and compensation are strongly related.

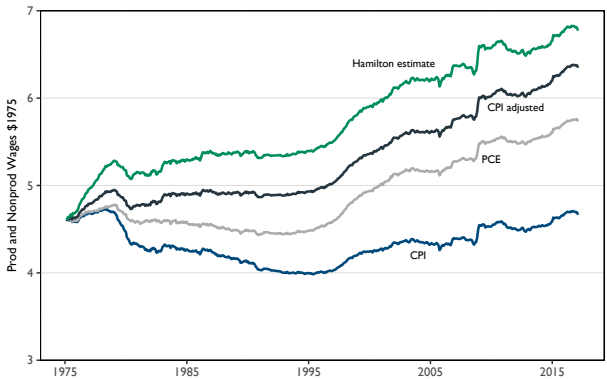
5. Stagnating Wages?

Implicit in the conversation over pay and productivity is that pay has been stagnant, with little or no growth for the typical worker since the 1970s. As with the relationship between pay and productivity, the question of wage growth is heavily influenced by the choice of inflation measure.

It is common for economists and analysts to use the consumer price index (CPI) to adjust wages for inflation over time. However, the CPI is not obviously the superior measure. The personal consumption expenditures (PCE) price index is the Federal Reserve's preferred measure of inflation. The PCE has many advantages over the CPI. Arguably, it's most important advantage is that, unlike the CPI, it accounts for the fact that consumers change the goods they purchase in response to price changes.

The next chart is produced by economist Bruce Sacerdote (2017).[5] The blue line represents average wages for production and non-supervisory workers, adjusted for inflation using the CPI. The green line represents the same wages, adjusted for inflation using the PCE. The red line represents those same wages, adjusted assuming that the CPI overstates inflation by 20% (a common, rough estimate of CPI bias). And the orange line deflates wages using a correction to the CPI proposed by economist Bruce W. Hamilton. The data run from 1975 through 2015.

Real Wages as Published and Adjusted



Source: Sacerdote (2017), used with permission.

Using the PCE, Sacerdote calculates real wage growth for production and non-supervisory workers of 24% from 1975-2015, or 0.54% per year. Removing 20% of CPI price inflation growth results in real wage growth of 0.76% per year. The Hamilton adjustment finds growth of 1% per year.

To be clear, I am not arguing that real wage growth of 0.5% per year is strong. I am making the weaker, but still important, claim that the dominant narrative of "no wage growth" in recent decades is heavily dependent on one's choice of inflation measure, and that there are good reasons to prefer other measures to the CPI.

6. The Need to Increase Productivity

In my view, wages and productivity are strongly linked. But that does not mean wage gains have been equally distributed across workers. Indeed, they have not been. Half of workers do not reach typical compensation levels (when defined as median compensation), and many workers do not reach average compensation levels.

5 In addition to what I discuss in this paper, Sacerdote also examines changes over time in the enjoyment of consumption goods such as cars and the size of homes among lower- and middle-income workers.

Public policy acknowledges this and has taken steps to correct it through the tax and transfer system. The nonpartisan Congressional Budget Office (CBO) reports that between 1979 and 2014, the sum of market income and social insurance payments among households in the bottom 20% of the income distribution grew by 26%. After taxes and transfers, income growth for this group of households was 69% (Congressional Budget Office, 2018).[6]

But more should be done. Given the strength of the link between pay and productivity, it is important for public policy to attempt to make workers, particularly low-wage workers, more productive. Policies to increase the skills of, and training available to, workers—for example, reforms to our K-12 education system and the expansion of apprenticeships and other forms of work- based learning—should be enacted. Earnings subsidies should be expanded to draw more people into the workforce. Policies to encourage business investment should also be considered. Labor market regulations that serve as barriers to workers and reduce the quality of matches between workers and jobs should be removed.

And policymakers should have confidence that measures to increase the productivity of workers will translate into higher pay.

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6 Income before taxes and transfers is defined as market income (labor, business, and capital income, in addition to other income related to market activities) plus social insurance benefits, including Social Security and Medicare, among others. Income after taxes and transfers is defined as income before taxes and transfers less federal taxes plus means-tested transfers, including cash payments and in-kind transfers such as Medicaid and food stamps, among others. These income measures are conceptually very different from what has been discussed in this paper, but they serve to illustrate the extent to which the tax and transfer system addresses inequality.

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