Pursuit - The Journal of Undergraduate Research at The University of Tennessee

Volume 4
Issue 2 *Spring 2013*

Article 4

March 2013

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Recommended Citation

Sheffield, James (2013) "Contending Theories of Wage Determination: An Intersectoral Analysis of Real Wage Growth in the U.S. Economy," *Pursuit - The Journal of Undergraduate Research at The University of Tennessee*: Vol. 4 : Iss. 2 , Article 4.

Available at: https://trace.tennessee.edu/pursuit/vol4/iss2/4

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Contending Theories of Wage Determination: An Intersectoral Analysis of Real Wage Growth in the U.S. Economy

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In recent years, social movements and popular media have drawn attention to the issue of income inequality in the United States. This growing inequality in the distribution of income is often seen as a function of stagnating wage growth in the U.S. economy. There appears to be a fairly broad consensus among commentators that wage growth for many workers in the U.S. has stagnated in recent decades, though the precise causes and implications of this trend are a matter of considerable dispute. Some see it as a function of stagnant productivity growth, while others attribute it to the declining strength of the labor movement. This paper uses multiple regression analyses in an attempt to provide an empirical means to judge the theoretical salience of these contending viewpoints. The results of this study indicate that while wage growth has in fact maintained a positive correlation with productivity, this correlation is much weaker than expected, particularly for manufacturing industries. Furthermore, while labor union strength appears to be an insignificant factor in the determination of wages for manufacturing industries, it retains a strong statistical significance in service sector wages. I argue that this finding reflects a historical shift in the composition of U.S. industry. The data gathered in this study supports the view that labor union density plays a role in the strength of wage-productivity elasticity, which raises important questions of how best to conceptualize wage growth and aggregate income distribution from the standpoint of economic theory.

Introduction

How do empirical trends in the U.S. economy give credence to contending conceptualizations of wage determination? That is, does empirical evidence suggest that wages are primarily a function of productivity (as neoclassical theory would suggest) or social forces (as some working in heterodox theoretical traditions would contend)? How might wage determination differ between sectors of the economy?

To answer these questions, I conducted a regression analysis of real wage growth in the U.S. economy since the mid-1960s. Separate regression models were constructed for the manufacturing (goods-producing) and service sectors. The results indicate that wages have maintained a positive correlation with productivity in both sectors, though this correlation is relatively weak for manufacturing industries. In addition, one measure of labor union strength is shown to be statistically insignificant for manufacturing industries while it retains a strong statistical significance for service industries. It would appear, then, that labor union strength could play a role in how wage growth responds to productivity increases.

Section 2 will briefly outline the objective of our analysis and its theoretical basis, while Section 3 will cover the choice of variables and the intuition behind their inclusion. Section 4 will explore the models to be estimated and will discuss issues pertaining to the choice of estimator. Section 5 will contain discussion of the results, along with suggestions for further research.

Theoretical Framework

In recent years, long-term trends in wage growth and income inequality in the United States have become important topics of debate in both the media and in academia. Contrary to hitherto prevailing assumptions about living standards, some evidence seems to vindicate the claims of those who argue that the standard of living for many U.S. citizens has faltered over the last several decades (Carter 2007; Mishel 2012). However, there is very little consensus over why wage growth has stagnated or how changes in wage growth over time should be conceptualized.

According to the neoclassical theory of distribution, real wages are equal to the marginal productivity of labor, which is a measure of the marginal contribution to a firm's output of hiring an additional worker, holding capital constant. The marginal productivity of labor (MPL), in turn, is assumed to be proportional to average labor productivity if the associated production function is characterized by a Cobb-Douglas form (Mankiw 2010). Despite long-standing claims that this characterization is misleading (Shaikh 1974), some empirical evidence shows a strong positive correlation between the growth rate of labor productivity and the growth rate of real wages in the post-war U.S. economy (Mankiw 2010).

However, the mere existence of this empirical correlation does not effectively validate the theory, for it does not tell us anything about who is receiving compensation increases and whether or not those recipients are responsible for the corresponding productivity increases. Moseley argues that disaggregating the data to distinguish between supervisory and non-supervisory workers would show "no close link between productivity and the real wage in recent decades" (2012, 123). Unfortunately, this claim cannot be corroborated, as the author does not provide a complete analysis.

Alternatively, there are those who contend that wages are a "socially determined variable" (Shaikh 2003, 131). As such, wages are perceived to be primarily a function of the strength of employees to force their employers to increase labor's share of income (Shaikh 2003; Carter 2007; Rowthorn 1980). Proponents of this view, which is characteristic of some heterodox theoretical traditions, would argue that employers have little incentive to voluntarily increase the wages of their employees and, as such, employees must actively strive to put pressure on their employers in order to increase or even maintain their standard of living due to inflation.

Although these two views are not necessarily mutually exclusive, they paint a very different picture of how wage trends change over time. An empirical analysis of trends in real wages over the last several decades would presumably allow us to substantiate some of these theoretical claims and conjecture their relative importance in aggregate wage determination. In light of Moseley's criticism, however, this analysis should control for possible discrepancies in wage/productivity correlation by disaggregating the data into those in charge (supervisory workers) and those not in charge (production and non-supervisory workers). Unfortunately, data on supervisory compensation are not readily available. However, data on production/non-supervisory workers are available; therefore, this study focused only on production/non-supervisory workers. With that said, it would be interesting to replicate this study for supervisory workers in order to see how trends in their compensation differ over time from that of non-supervisory workers.

In order to control for changes in the industrial composition of the U.S. economy over the decades in question, separate models for goods-producing and service-providing industries were estimated. This allowed for an evaluation of how these industries interact and how they are differentially impacted by macroeconomic dynamics. It should be noted that in this study, all personal characteristics of individual workers (i.e. race/ethnicity, gender, education level, etc.) were abstracted, not because these factors are irrelevant but because this study focused on an examination of wage trends in the context of aggregate income distribution, and in this regard such characteristics as gender and educational level are beyond the scope of this paper.

Variable Selection

The variables chosen are intended to capture the effects on wage determination from several different sources. The choice of wage measure, in particular, deserves some justification.

The data on employee earnings have been deflated by the CPI-W (Consumer Price Index for urban wage earners and clerical workers), which adjusts for changes in the prices of consumer goods. There are two caveats to this choice: First, it is argued that in order to remain consistent with marginal productivity theory measures of employee compensation must be deflated by the implicit price deflator for the sector in question rather than the standard consumer price index, which is how the BLS calculates real earnings (Sullivan 1997). This would deflate earnings in a manner that accounts for changes in the cost of producer goods (i.e., the goods that producers purchase as inputs into the production process). From the consumer's perspective, however, purchasing power is a function of how many consumer goods can be bought with those earnings.

Therefore, it makes more sense to use a consumer price index if one is concerned with wages as *purchasing power* rather than as *costs*. This is more consistent with the question of how real wages (i.e. purchasing power) have changed over time. Another caveat to the choice of earnings data is that, due to limitations in data availability, they do not reflect changes in employee benefits (e.g. insurance, retirement, etc.). However, accounting for these benefits has a relatively slight impact on the absolute magnitudes of employee compensation and does little to affect the long term trend in wage changes (see Mishel 2012, charts 1 and 2). Furthermore, the change in benefits as a proportion of total compensation over the last several decades has been negligible (Mishel 2012) and therefore will not jeopardize our results.

Measures of output per hour worked will allow us to account for changes in productivity, which theory would suggest exhibits a strong positive correlation with wage growth.[2] Presumably, as workers become more productive their employers are going to be willing to pay them more for their labor power. It is a little more difficult, however, to quantify the pressure that employees put on employers for better pay. Since labor union strength has historically played a strong role in working-class struggle with employers for wage increases, I chose to analyze two variables pertaining to labor union strength. Following Carter (2007), I included a variable for union density measured as the percentage of the labor force unionized in any given year. Since union density does not necessarily capture union activity, I also included the annual number of work stoppages involving 1,000 or more workers. In addition, I included a variable for the federal minimum wage rate in order to capture the effect of federal labor standards on wage growth. All other variables are intended to control for the effects of supply and demand in the labor market, with the exception of a dummy variable intended to capture the effects of war on the labor market.

Table 1. Explanation of Variables[1]

Variable	Description	Sample Mean (Standard Deviation)
Ln(gdswge) (Dependent)	Average hourly earnings of production/non-supervisory employees, goods-producing industries, 1982-84 dollars	2.21 (0.04)
Ln(srvwge) (Dependent)	Average hourly earnings of production/non-supervisory employees, private service-providing industries, 1982-84 dollars	2.09 (0.06)
Wrkstp (+)	Annual work stoppages involving 1,000 or more workers	131.6 (135.07)
Unmprt (-)	Annual average unemployment rate, civilian labor force (16 years and over)	6.05 (1.65)
Ln(prdctvtyg) (+)	Output per hour (2005 = 100), manufacturing sector	3.98 (0.44)
Ln(prdctvtynfrm) (+)	Output per hour (2005 = 100), nonfarm business sector	4.24 (0.26)
Lbrfrcunn (+)	% of labor force unionized (private sector)	16.15 (8.15)
Ln(minwg) (+)	Federal minimum wage rate, 1982-84 dollars	3.37 (0.53)
Gdshrs (+)	Average weekly hours of production/non-supervisory employees, goods-producing industries	40.17 (0.52)
Srvhrs (+)	Average weekly hours of production/non-supervisory employees, service-providing industries	33.57 (1.49)
Mnftempl (+)	# of production and non-supervisory employees in goods producing industries	16817.85 (1261.86)
Gdpgrwth (+)	Annual GDP percent change, 2012 dollars	6.93 (2.97)
War (+)	Dummy variable = 1 if U.S. involved in war	0.52 (0.51)

Econometric Models and Estimation Methods

The following models were estimated[3]:

$$gdswge_t =$$

$$f(\, wrkstp_t, unmprt_{t-1}, prdctvtyg_t, lbrfrcunn_t, minwg_t, gds\#rs_t, gdpgrwt\#_t, war_t) + \varepsilon_t$$

(1)

$$srvwge_t =$$

$$f(wrkstp_t, unmprt_{t-1}, prdctvtynfrm_t, lbrfrcunn_t, minwg_t, mnftempl_t, srv\#rs_t,$$

$$gdpgrwt\#_t, war_t) + \varepsilon_t$$

(2)

Natural log transformations were used where appropriate, as indicated in Table 1. In particular, variables pertaining to wages, productivity, and minimum wage were transformed so as to facilitate convenient interpretation.

Time-series data were gleaned from various government sources, particularly the Bureau of Labor Statistics and Bureau of Economic Analysis[4]. All observations are annual measures. The decision to use annual data was partly motivated by a desire to account for a longer time period and partly by limited availability of data for particular variables. There are 48 observations in our dataset, corresponding to the years 1964-2011.

In order to test for first-order serial correlation, both models were estimated using Ordinary Least Squares and then a separate regression was performed on the residuals with the residuals from the time period immediately prior to the current period as the explanatory variable and ϱ as the coefficient. The associated test statistics are reported in Table 2. In both instances a null hypothesis of no serial correlation was rejected, indicating the need to correct for this. Given the relatively small sample size, the use of a Prais-Winsten estimator was chosen as a remedy for serial correlation in the error terms.

A White test was conducted on the Prais-Winsten estimated residuals and coefficients from model 1 in order to check for possible heteroskedasticity issues. The associated test statistics are reported in Table 2. Based on a chi-square test, a null hypothesis of constant error term variances was rejected, and thus the final estimation procedure was conducted using robust standard errors as a remedy for possible heteroskedasticity. This was also conducted for model 2, given its strong resemblance to model 1.

Results

Table 2 contains the estimation results for both models. It would appear that for goods-producing industries, productivity change has been one of the primary indicators of real wage growth for production/non-supervisory employees, and likewise for those working in the service industry. However, the wage/productivity elasticity is weaker than expected for the former, while it is especially strong for the latter. This could be due to the fact that the service sector is relatively labor intensive, thus leading employees to capture a greater proportion of increased output. Furthermore, increases in average weekly hours worked appear to have a slight negative impact on average hourly earnings. Though this is contrary to what was initially expected, it is not necessarily inconsistent with intuition if one considers the possibility that stagnant or declining real earnings could lead to an increase in weekly hours worked as employees try to make up for the loss in purchasing power.

What may appear to be particularly surprising here is the relatively slight impact of unionization on the earnings of goods-producing employees. Contrary to intuition, the influence of unions is statistically insignificant for those industries, which are typically considered bastions of union strength. However, the reasons for this are likely historical. Given that our data only cover the last five decades, the majority of the time period in question has been characterized by a decline in the density and strength of manufacturing labor unions. Union density declined from a high of 31% in 1964 to a low of 6.9% in 2011. This decline was relatively slight throughout the 60s and 70s, but became more dramatic around the turn of the 1980s. Therefore it is actually not very surprising that the overall impact of unions on wage growth in our models has been negligible. It should be noted, however, that as a consequence of shifts in the composition of U.S. industry, service-sector employment has grown throughout the period in question. This could explain why union density maintained a statistically significant, positive impact on service-sector earnings.

Carter has indicated that the wage share of total output began to decline around 1979, suggesting that "a regime change occurred in international primary distribution, one associated with a decrease in the wage share … as wage earners in many countries experienced erosion in their command of output produced" (2007, 581). A preliminary analysis suggests that if the time period is disaggregated into the years prior to 1979 and the years following 1979, the picture looks very different. Appendices 2 and 3 contain the results of this analysis. Most of the variables analyzed in this study are statistically significant for the years leading up to 1979 and statistically *insignificant* for the years after 1979. Given the small sample sizes associated with these additional regressions, one should not consider these results conclusive. However, this does suggest that some of our unexpected findings could be the result of changing historical and political regimes in the U.S. This would appear to justify a more thorough analysis of these specific periods.

Table 2: Estimation Results for 1964-2011

Natural log of average hourly earnings of production/non-supervisory employees, 1982-84 dollars

Variable	Model (1)	Model (2)
Constant	2.12** (0.44)	-1.492 (0.952)
Wrkstp	0.0000286 (0.0000695)	-0.00004 (0.00006)
Unmprt	0.003 (0.003)	0.005 (0.004)
ln(prdctvtyg)	0.16** (0.064)	
ln(prdctvtynfrm)		0.537** (0.122)
Lbrfrcunn	0.002 (0.004)	0.0095** (0.0039)
ln(minwg)	0.023 (0.047)	0.034 (0.042)
Gdshrs	-0.017** (0.008)	
Srvhrs		0.028* (0.016)
Mnftempl		8.04e-06 (6.91e-06)
Gdpgrwth	0.002* (0.001)	-0.002* (0.0014)
War	-0.0008 (0.009)	0.0067 (0.0094)
N	47	47
R^2	0.9512	0.9633
F-statistic	2.41	2.8
χ^2	46.7979	0.000
p-value (ρ)	0.000	0.000

Note: Standard errors in parentheses.
* and ** denote statistical significance at the 10% and 5% levels, respectively

Conclusion

Our analysis has shown that from an empirical standpoint the connection between wage growth and productivity changes remains significant, if not strong. However, it also suggests that the "organizational or institutional strength of labor" is an important factor to consider when dealing with questions of wage determination and income distribution (Shaikh 2003, 139). Therefore, whether stagnant real wages are primarily a function of declining productivity (Sullivan 1997) or the declining strength of labor is difficult to determine for sure. It would appear, though, that both should be accounted for in future empirical investigations, lest too much emphasis be placed on one at the expense of consideration of the other.

It would be interesting to follow up this study with a more detailed analysis of wage trends in specific historical periods, perhaps utilizing sub-annual time periods as a way of increasing sample size and estimation accuracy. Furthermore, a similar analysis of trends in supervisory-employee earnings is certainly warranted. Hopefully these kinds of studies can shed light on some of the most pressing economic issues of our time, providing insight into how policy initiatives might curb the growth of income inequality and poverty in the 21st century.

Endnotes

1 Data sources cited in Appendix (1)

2 The choice of productivity measure was motivated by a desire to match the hourly measurement of wages.

3 See Table 1 for description of variables, including summary statistics.

4 See Appendix (1) for precise information on data sourcing.

Appendix 1: Data Sources

Bureau of Economic Analysis. *GDP percent change from preceding period*. Available from http://www.bea.gov/national/index.htm#gdp. Retrieved November 12, 2012.

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Appendix 2: Estimation Results for 1964-1979

Natural log of average hourly earnings of production/non-supervisory employees, 1982-84 dollars

Variable	Model (1)	Model (2)
Constant	2.098** (0.615)	-6.39* (2.71)
Wrkstp	0.00023** (0.00003)	0.0003** (0.000057)
Unmprt	-0.0045 (0.0024)	-0.027** (0.005)
ln(prdctvtyg)	0.552** (0.082)	
ln(prdctvtynfrm)		1.739** (0.388)
Lbrfrcunn	0.01** (0.0013)	0.017** (0.0016)
ln(minwg)	-0.221** (0.032)	-0.284** (0.066)
Gdshrs	-0.049** (0.0096)	
Srvhrs		0.0585 (0.032)
Mnftempl		-0.00003** (7.24e-06)
Gdpgrwth	0.014** (0.0035)	0.01118* (0.0047)
N	15	15
R^2	0.9999	0.9999
F-statistic	801.41	147.13

Appendix 3: Estimation Results for 1980-2011

Natural log of average hourly earnings of production/non-supervisory employees, 1982-84 dollars

Variable	Model (1)	Model (2)
Constant	2.457** (0.423)	-0.332 (0.874)
Wrkstp	6.03e-06 (0.00016)	-0.0001 (0.00016)
Unmprt	0.0033 (0.0022)	0.0019 (0.0049)
ln(prdctvtyg)	0.074 (0.063)	
ln(prdctvtynfrm)		0.434** (0.0928)
Lbrfrcunn	0.0025 (0.006)	0.0123** (0.0048)
ln(minwg)	0.036 (0.05)	0.0286 (0.0529)
Gdshrs	-0.016** (0.008)	
Srvhrs		0.0096 (0.0212)
Mnftempl		1.26e-06 (0.00001)
Gdpgrwth	0.00097 (0.0011)	-0.0017 (0.0018)
N	32	32
R^2	0.9953	0.9960
F-statistic	1.33	18.00

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