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The Effect of Increases in Labor Supply on Real Wages

Christopher M. Jahnke
Eastern Illinois University

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The Effect Of Increases In Labor Supply On Real Wages

(TITLE)

BY

Christopher M. Jahnke

THESIS

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Abstract

The working class citizen is an important part of the United States. However, the manufacturing worker is getting paid less in real terms now, than in 1975. Because of this, working harder for less has become the battle cry of the blue collar worker. This study is focused on examining the decline in average real hourly wage in manufacturing.

The hypothesis of this paper is that large increases in female labor force participation rates have caused average real wages to fall since 1966. This hypothesis is examined through multiple regression analysis based on a model with three independent variables. The regression takes into account business cycle, productivity, and labor supply variables. Through examination of the statistics, this paper finds a negative relationship between the average real hourly wage and increases in labor force participation rates. Furthermore, the paper examines the marginal revenue product theory of labor, by showing at times, factors other than those linked to labor demand can be influential in wage determination.

This study is focused on the influence of labor supply on average real wage. It is a starting point for further examination into labor supply fluctuation. Furthermore, this study sets up a model for investigation into labor supply fluctuations of other countries.

Dedication

I would like to dedicate this work to my parents. Without their help and support, none of my achievements would have been possible.

Acknowledgments

There are many people I would like to thank for their help and support. I would like to thank my parents, William and Barbara Jahnke, for more than I could possibly write. I would also like to thank my brothers, Corey and Craig Jahnke, for providing me with an avenue for advice and also my sister in law, Tonya Jahnke, for reminding me of what a person can achieve if they put their mind to it. I also would like to show appreciation to Kyle Strohman, James Walsh, Mario Merlano, Matt Thrun, and Rudy Stefanski, for being great friends and roommates. A special thank you is necessary for Erin Williamson, because of her support during a tough year. Dr. Tim Mason and Dr. Patrick Lenihan, your time and effort spent on my thesis project is greatly appreciated. I would also like to thank Coach Ray Padovan, for influencing my work ethic and approach to achieving personal goals, Dr. Edward Corley and Dr. Larry Bates for being excellent advisors and educators, and Dr. Peter R. Leigh for all the help, wisdom, and direction he has given me. Furthermore, I would like to thank Dr. E. Karbassioon for all his help, guidance, and conveyance of knowledge.

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SECTION I.

Introduction

People who live in the United States are constantly reminded of the "American Dream". That is, working hard enough will get you anything you want. Because of this constant reminder it seems a given to many people in the U.S. that hard work leads to fortune. In economics, this idea is also is supported. Neo-classical labor theory states that as a worker's marginal productivity rises, (a measure of one's hard work), the wage the worker is paid should go up. In other words, more productive work should mean a higher paycheck. Unfortunately, historically this is not always the case. As depicted in Figures 1 and 2, from 1975 to 1993 average output per worker increased, while average real wage declined.

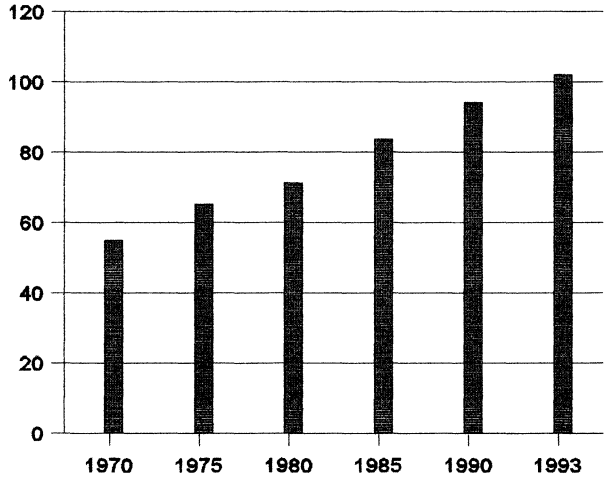

Figure 1. Average real output per worker in manufacturing (1992=100) From Employment Hours and Earnings, 1903-1993

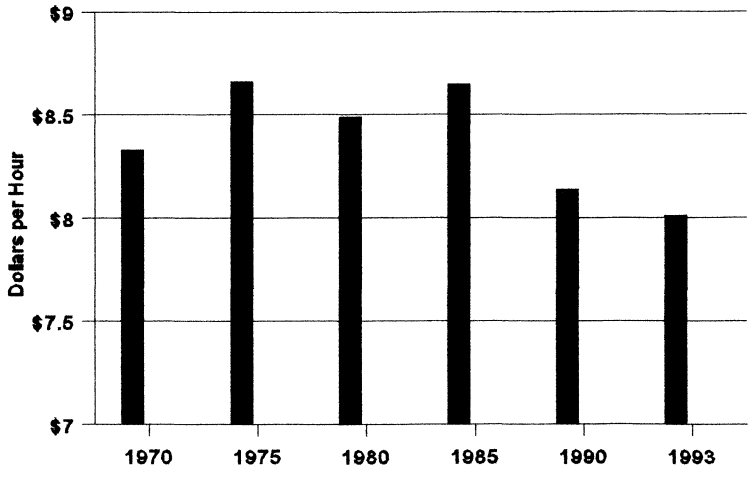

Figure 2. Average real hourly wage in manufacturing (1982 dollars) From Employment Hours and Earnings, 1903-1993

This trend has caused many to feel as if they are working harder for less and hints at an exception to the rule that marginal productivity of labor, a component of labor demand, is the most important factor in wage determination.

The demand for labor, which is the marginal physical product of labor multiplied by marginal revenue, is generally seen as the major factor in influencing wage fluctuations. However, the hint of an exception to this rule has me interested in alternative explanations to fluctuations in real wage. These explanations could benefit

third world nations.

If shifts in labor supply can, at times, have a greater impact on wage fluctuation than changes in the marginal productivity of labor, then a warning would be issued to developing countries about the restructuring of industry. Developing countries which move from agrarian- to manufacturing-based economies experience a surplus of labor in agriculture. This surplus causes lower wages in agriculture and forces the agrarian labor force to move to manufacturing, thus causing a shift in labor supply to manufacturing. If this shift can cause downward pressure on wages for manufacturing, then disparity could follow. Even though lower wages and disparity could send the appropriate message to the labor force participants about where to allocate their labor, during restructuring, a participant may not have a choice of what area to work in due to geographic or political barriers. Furthermore, participants in the labor force may not have the appropriate skills required to obtain employment. If lower wages are the result of supply shifts, hardship may be the result for the working class citizen.

It seems likely that at times, the average wage can be significantly affected by factors which are not linked to labor demand. In fact, basic theory predicts that increases

in the supply of labor should put downward pressure on wages, *ceteris paribus*. After 1966 the labor force participation rate for women began rising more rapidly in the U.S. By 1990, the participation rate of women had risen to 57.5%, an increase of 17.2 percentage points since 1966. (Employment, Hours and Earnings 1909-1993, 1995). This has more than offset a small decline in participation rate for men, and possibly put downward pressure on real wages. Table 1 shows a comparison between the labor force participation rates of men and women.

Table 1

Labor Force Participation Rates

Group	Males	Females
Rate in 1966	80.4%	40.3%
Rate in 1990	76.4%	57.5%
Change	-4.0%	+17.2%

From Employment Hours and Earnings, 1903-1993

The real world influence of this increase in labor supply will be the focus of this study.

The effects of a labor supply shift are extremely relevant to developing nations which have sectoral shifts in the supply of labor. Increases in supply to one sector may

lower wages in that area and cause disincentive for effort. This could be overwhelming to developing nations, therefore the effects of supply fluctuation must be examined.

Section II.

Literature Review

The literature pertaining to real wage fluctuation is heavily dominated with studies that measure productivity shocks and business cycle trends. A widely held belief is that business cycle phenomena lead to real wage fluctuation. However, Abraham and Haltwinger (1995) note that the business cycle theories with respect to wage fluctuation are filled with controversy and conflicting hypotheses. Stephen Silver (1995) further states that although there have been many studies done on the cyclicality of real wages in the U.S., there has been no consensus formed about the implications of findings for business cycle theory. Silver also notes, in some cases business cycle models have been found to be inconsistent with the observed cyclicality of wages. However, examination of these and other studies is necessary in order to provide a background against which the current study may be judged. Therefore, studies based on productivity and related labor supply studies will be reviewed first. Then business cycle literature will be examined followed by literature critical of these business

cycle studies. Then labor supply literature will be examined followed by literature on developing nations.

Hercowitz and Simpson (1991) argued that temporary productivity shocks can have permanent effects on real wages especially if production growth is assumed to be determined endogenously by mechanisms not linked to technological advance. Hercowitz and Simpson claim that sharp increases in hours worked are a measurement of productivity shocks because increases in hours worked are linked to output as a whole. Furthermore, if growth is based only on production mechanisms, then increasing the work week will lead to higher productivity which should lead to higher wages according to the Hercowitz and Simpson study. However, the measurement of productivity by hours worked as well as their main assumption, must be questioned.

By assuming that production growth is not linked to technological advance, Hercowitz and Simpson simplify production too much. Furthermore, stating that the number of hours worked is a measure of productivity shocks is inappropriate. A worker's productivity per hour does not increase as the number of hours worked is increased, but rather, the total output per work day. Furthermore, as a worker begins to get tired after a long day, the marginal productivity may actually fall. If overtime pay is taken

into account, obviously the average earnings will increase. Perhaps this variable (hours worked) may be better used as supply variable, as seen in a study by Algoskoufis.

Algoskoufis (1987) argues that the Intertemporal Substitution Hypothesis (ISH) states that labor supply responds positively to increases in real wage and increases in interest rates. Algoskoufis notes however, that this hypothesis is being reassessed on both the macro and micro level. Algoskoufis' results support the relationship described in the (ISH), however his results challenge the hypothesized direction of causality.

Using hours worked per week as a measure of supply, Algoskoufis concludes that labor supply shifts lead to opposite changes in wages. However, the use of this variable as supply decision measurement may not be appropriate. This is a more proper way to use the hours worked variable than the way Hercowitz and Simpson did because it reflects the decision of workers to sacrifice extra leisure time in order to work more hours. But hours worked is not a sufficient measure of labor supply because they reflect an individual's labor supply and not an aggregate of individuals competing for work. Adding more workers and thus increasing total hours worked is a hiring decision and not a supply decision. Many times employees

are strongly urged to work overtime due to increases in demand for the finished product. Algoskoufis' work in labor supply leads toward an investigation into the relationship between real wage and labor supply. However, in constructing a model to test the effect of labor supply shocks on the average real wage, it is more appropriate to use labor force participation rates as the measurement of labor supply.

While studies have been done on the effect of productivity on wages, others have done studies on business cycle effects. Abraham and Haltwinger (1995) suggest that the business cycle may influence wages more than productivity itself. Because nominal wages and output are affected by downturns in the business cycle, the average real wage is also affected. Furthermore, Abraham and Haltwinger state that business cycles may raise the price level and consequently affect the real wage through this route. Although Abraham and Haltwinger focus on the business cycle, they suggest that the supply of labor could be influential to real wage as well.

Abraham and Haltwinger (1995) state that labor supply shocks can have big effects on local labor markets. They further characterize the national labor markets as merely large webs of local markets. This clearly suggests that

labor supply shocks could have an effect on a national level. Kandil (1996) argues that labor demand shocks are not as influential on real wage as they used to be. Both studies lend support to the idea that factors other than productivity shocks and business cycle phenomena play important roles in the fluctuations of wage. These studies validate investigation into the relationship between labor supply and average real wage which is the basis of this paper.

Koray, Lee, and Palivos (1996) challenged the idea that fluctuations in wages and incomes were caused by cyclical components of basic business trends. The group premised their experiment on productivity shocks which they felt could explain fluctuations in wages. Koray *et al.* concluded that income and wages are correlated with each other and share a stochastic trend related to productivity. The group also concluded that total income and labor income share stochastic trends related to productivity. While Koray *et al.* argue that productivity has a large influence on wages, another study contradicts this claim and suggest the relationship can work in reverse.

Groshen (1991) argues that efficiency wage theory holds that increases in wages lead to higher productivity, because it decreases a worker's incentive to relax on the job.

Reasons for this include increased loyalty to the company, less pay for similar jobs at other employers make the person value the job more, and increased satisfaction of the worker. If efficiency wage theory is correct the cause and effect relationship between productivity and real wage may be reversed.

Keenan (1988) evaluated the relationship of aggregate labor supply fluctuation with real wage in a 1988 study by conducting a study that examined data from the years 1948-1971. He noted that there was evidence that real wage influenced employment. However, Keenan also stated that when his model was extended to 1981, there was no significant relationship between the two variables. By extending the study through the 1970s Keenan experienced trouble. Perhaps some of the problems that Keenan encountered when extending his study through the 1970s can be solved by review of Lilien's work.

Lilien (1982) concluded that labor supply shocks are an important source of cyclical unemployment and deserve greater attention in the literature. Furthermore, Lilien concluded that aggregate demand shortcomings were not the cause of high unemployment in the 1970s. Lilien demonstrates that the cyclical pattern of unemployment over the decade provides supporting evidence that unusually large

shifts in labor supply contributed to unemployment increases. It seems probable that these increases in unemployment affected wages. Therefore, the labor supply shocks contributed to declining real wages in the 1970s. This may be what biased Keenan's results when he extended his model. But why were the 1970s different? A review of Parker's results may provide some answers.

Parker (1992) claims that many studies have ignored the changing demographics of the United States labor force. Changing demographics in the work force really began in the mid-1960s and continued strongly through the 1970s. The political setting of the time enabled civil rights movements which furthered equality in the work force. This changed the demographic setting of the labor force and may have affected real wages through unemployment. Parker also states that sectoral shifts had a large effect on unemployment in the 1970s. Even though this could explain the reasons for high unemployment the 1970s, it may not apply to the 1980s.

Partridge and Rickman (1995) concluded that during the 1980s, the dispersion in state and regional unemployment rates increased the natural rate of unemployment on the national level. The two concluded that this was a result of inefficient labor force allocation. Partridge and Rickman

also stated that employment shifts during the 1980s were significant in explaining state unemployment differences, thus lending evidence from the 1980s to the basic labor market theory that unemployment rates were linked with supply shifts.

Palley (1992) also found that sectoral shifts and unemployment rates are positively correlated. Blackley (1997), too, concluded that sectoral shifts in employment can lead to higher unemployment in the short run. However, Blackley stated that the severity of the impact depended on the state of the macro economy. There also seems to be evidence that unemployment rates affect real wages. While the aforementioned studies provide examples of the connection between supply shifts and real wage fluctuations after 1970, the question of what causes increases in labor supply still remains. Grossberg attempts to provide an answer.

Grossberg (1991) argues that increases in uncertainty of labor market fluctuations will cause an increase in labor force participation rates. Grossberg argues that because people base decisions on what they expect to happen in the future, when expectations change labor supply decisions change as well. Changes in economic forecasts or even political changes which interfere with expectations can

affect the supply of labor. Policy changes which affect the supply of labor can be seen in developing nations and, therefore, an investigation into this topic may be important to developing economies. Studies by Southgate and DeJanvry *et al.* show evidence that the supply of labor may be shifting in developing nations already.

Southgate (1990) states that, in 1987, 60% of Ecuador's employment was in agriculture. DeJanvry, Sadoulet, and Fargeix (1991) point out that from 1975 to 1980 manufacturing output grew in Ecuador at an average rate of 9.4% per year while agriculture grew at a 1.3% rate. This shows that the structure of Ecuadorian industry is changing and like other developing nations, Ecuador is still a largely agrarian-based society. Because of this, Ecuador will deal with the adverse affects of labor supply shifts if they do not restructure their economy carefully. People will be forced to move away from their jobs in agriculture as the economy moves away from food production as a mainstay of employment. If Ecuador plans to move to a manufacturing-based economy, it should take note as to what effects a large labor supply shift could have on the well-being of their working class.

Ecuador is not the only country which may see structural changes that lead to shifts in employment. Sachs

(1996) states that structural adjustments in the form of resource reallocation is one of the basic tasks of Eastern European countries whose economies are in transition. Sachs states that this reallocation tends to be directed toward heavy industry where these countries may not have been producing. This again presents a scenario for movement of an agrarian labor force to a manufacturing labor force. Brainard and Cutler (1993) suggest that if workers must undergo time consuming processes for retraining in order to move among employment sectors, unemployment may rise even if expansion in one area offsets declines in others. Therefore, even if there is enough new expansion in manufacturing, when a developing nation is restructuring its economy, the mis-matched skills of workers may cause higher unemployment due to retraining time. Thus a surplus of labor is created in one sector as a result of restructuring and wages are affected.

Clearly further research is needed on the relationship between labor supply shift effects and real wages. Algoskoufis (1987) developed a cause and effect relationship with respect to labor supply fluctuations and real wages. Keenan (1988) also established a causal relationship between real wages and labor supply shifts through a time series study from 1948 to 1971. However, evidence that this

relationship changed after 1970 is provided by Keenan's own study which found his model lacking when extended ten years further. Lilien (1982) also concluded that unemployment in the 1970s was caused by supply shifts. Parker (1992) supports Lilien and further states that changing demographics should also be considered. Partridge and Rickman (1995) conclude that employment shifts were influential to unemployment during the 1980s.

Because it seems likely the relationship between real wages and supply (as Keenan diagnosed) may have changed, the effects of labor supply shifts on real wage fluctuations after 1970 must be examined. While much work has been done on real wage fluctuations with respect to the business cycle and productivity shocks, no clear answers have been found. As Abraham and Haltwinger (1995) state, the business cycle literature is filled with controversy. Since business cycle examinations have been done many times with no real consensus and the relationship established between real wage and supply by Keenan seems to have changed, there is a need for further testing to be done on the effect of labor supply shifts on real wages.

Section III.

Explanation Of Variables, Hypothesis, and Models

The main hypothesis is that real wages have been

negatively affected by increases in the supply of labor from 1966 to 1990. In particular, the labor force participation rate of women has risen particularly rapidly during this time period. Because of the increase in the labor force participation rate of women, it is hypothesized that there has been downward pressure on real wage rates due to an excess supply of labor. In order to study the hypothesis, various regressions were run which were based on models used in previous studies. The labor force participation rate of females and the labor force participation rate for the entire country were both used as measures of supply. However, massive multicollinearity problems caused the need for a different measure of supply.

To examine the relationship between labor supply and real wage, a new model has been developed using data from the manufacturing industry (because the data are most easily attained in this industry). Two variables in the model are typical of business cycle literature previously reviewed. However, one variable is a supply variable, which is a new approach.

The model will examine the relationship between the average real wage and a ratio of female labor force participation rate to overall labor force participation rate. It will also include business cycle and productivity

variables. The model equation is:

$$\%\Delta \text{Real Wage} = \alpha + \beta_1(\text{F-LFPR/LFPR}) + \beta_2(\%\Delta \text{Output}) + \beta_3(\%\Delta \text{GDP}),$$

where:

%ΔReal Wage = the annual percentage change of the average real wage in the manufacturing sector,

F-LFPR/LFPR = overall female labor force participation rate (F-LFPR) divided by the overall labor force participation rate (LFPR),

%ΔOutput = the annual percentage change in average real output per worker in the manufacturing sector, and

%ΔGDP = the annual percentage change in real GDP for the manufacturing sector.

The percentage change from year to year of real wages in the manufacturing sector is adjusted to 1992 dollars. The data used for this variable were collected from Employment Hours and Earnings, 1903-1993. Its fluctuations will be explained by the fluctuations in the following variables:

F-LFPR/LFPR is the female labor force participation rate (F-LFPR) divided by the labor force participation rate for the entire population (LFPR). This variable provides a

ratio for examination of increases in the female labor force participation rate. If F-LFPR/LFPR rises, then either the F-LFPR is rising faster than the LFPR (which means the F-LFPR is increasing at a faster rate than the male participation rate), or the LFPR is declining faster than the F-LFPR (which means the F-LFPR is decreasing less rapidly than the male participation ratio). The data clearly indicate that during the period of the study the F-LFPR is increasing while the male participation rate is falling. Thus, the overall LFPR is still increasing, but not as fast as F-LFPR.

This variable was developed in response to the shortcomings of previous studies. The supply variable (hours worked per week) used by Algoskoufis (1987) is not an accurate measure of labor supply shifts. Furthermore, unemployment rates, which are used in many studies, are a measure of labor surpluses. This study is concerned with increases in labor supply, in particular the effects of the changing supply of women in the workforce. Therefore, it was necessary to construct a variable which depicted the changing ratio of female labor force participation rates to the labor force participation rate as a whole.

The expectation is that this variable will be negatively correlated to the average real wage. As the

amount of women in participation rises relative to men, downward pressure will be put on wages as long as the overall LFPR increases as well. This may be due to pay inequality between sexes, less skilled labor entry, and increased supply of labor as a whole (for the years of this study).

The data for the change in average real output per worker in the manufacturing industry from year to year were taken from Employment Hours and Earnings, 1903-1993. This variable provides a productivity variable and a measure of output per worker. As a worker's productivity rises basic theory dictates that the level of the worker's pay should rises as well. Because of this, changes in the average real wage should be positively correlated to percent change in output.

The data for the annual percentage change in real GDP for manufacturing were taken from The Economic Report of the President. It is the change in total output for manufacturing per year. This is a common variable used in business cycle literature. It provides a business cycle variable and a measure of magnitude for economic prosperity in the manufacturing industry. As basic theory dictates, in times of economic prosperity wages should rise. Therefore, the expectation is that changes in the average real wage

should be positively correlated to percent change in GDP.

SECTION IV.

Results

The results of the model proved to be very interesting. The model showed an R-squared result of .804. This means that 80.4% of the variation in real wages is attributed to the independent variables. The F-stat for the regression was 28.7, which indicates the regression as a whole is highly significant. These results can be seen in the appendix.

By examining the estimated regression coefficient of each variable (see appendix), it can be determined whether the variables are positively or negatively correlated to changes in the average real wage. Furthermore, the estimated regression equation can be derived. The regression equation is estimated as:

$$\%\Delta \text{Real Wage} = 0.043 - 0.099(\text{F-LFPR/LFPR}) + 0.77(\%\Delta \text{Output}) + 0.099(\%\Delta \text{GDP})$$

The t-stats for each independent variable as well and its P-value show the level of significance for each independent

variable. Each independent variable is shown to be significant at the 1% level. The P-values and t-stats for this regression are reported in Table 2.

Table 2

Regression Statistics

Variable	t-stats	P-value
F-LFPR/LFPR	-3.3192	.0032
Change Output	6.7339	1.15 E-06
Change GDP	5.3021	2.94 E-05

The estimation shows that F-LFPR/LFPR is negatively correlated with real wage, while changes in GDP and output per worker are positively correlated with real wage as expected. Because it is found that F-LFPR/LFPR is negatively correlated with real wages, it can be said that when either the female labor force participation rate rises faster than the male labor force participation rate or the female labor force participation rate falls less quickly than the overall labor force participation rate, the average real wage will decline. However, the data in this regression show that during this period both the F-LFPR and the LFPR were rising, with the F-LFPR rising faster. Therefore, this regression shows that for this time period

the larger increase in F-LFPR is negatively related to real wage. This result is consistent with the hypothesis.

The positive correlation and high significance of the two other variables, %ΔGDP and %ΔOutput, is as expected. The results confirm basic theory's prediction that as economic prosperity increases and average productivity increases, wages will also rise.

While the results of the regressions were great as a whole, any time a regression is run it must be checked for bias. Therefore, tests for multicollinearity, heteroscedasticity, and autocorrelation were all performed. The results of the tests proved to support the validity of the model.

Multicollinearity Test

Multicollinearity occurs when the independent variables are related to each other. When this occurs it is impossible to determine how significant each independent variable really is. Furthermore, the estimated coefficients can be biased. Therefore, this test must be done in order to prove that the significance of the variable really is what the regression says it is and the coefficients are unbiased estimates.

In order to test for multicollinearity we examine the correlation matrix. If the absolute value of the

correlation between (X1,X2) is greater than the absolute value of the correlation between (Y,X1) or (Y,X2), then multicollinearity exists. The correlation matrix for the model can be found in the appendix.

Examination of the correlation matrix indicates that multicollinearity does not exist in the model and thus all significance levels are proper and the coefficients of estimation are not biased. The results of the multicollinearity examination support the validity of the model. However, each model must hold up to tests for heteroscedasticity and autocorrelation in order to be completely valid.

The Goldfeld-Quant Test For Heteroscedasticity

In time-series models, heteroscedasticity is usually not a problem. However, it is not out of the question and must be checked. Heteroscedasticity occurs when the variance of the regression's error terms are not constant. Heteroscedasticity biases the standard errors estimation of coefficients, thus throwing off the significance level of the independent variables. Therefore, a test such as the Goldfeld-Quant Test is used to check for heteroscedasticity.

The Goldfeld-Quant test is performed by sorting the observations from low to high values of the dependent variable and then omitting the middle twenty percent of

observations. Then regressions are preformed on the top and bottom 40%. The ANOVA tables for each regression provide the numbers for the sum of squares for the residual. When the sum of squared errors from the bottom 40% of observations after sorting (divided by the degrees of freedom) is divided by the sum of squared errors from the top 40% of observations after sorting (divided by the degrees of freedom) an F-stat is calculated. This F-stat is then compared to the critical F-value. If the calculated F is greater than the critical F-value, then heteroscedasticity exists.

The critical F-value for this model is 3.18. The Goldfeld-Quant results for the model can be found in the appendix. The calculated F-stat is 0.288. This result indicates that the model has no heteroscedasticity problems. This further validates the model's statistical credibility and shows that the standard errors estimation of coefficients are not biased. Furthermore, the results show that the variance of the error terms are constant.

The model has passed the tests for multicollinearity and heteroscedasticity. However, one test remains in order to establish complete statistical credibility. That test is for autocorrelation.

Test For Autocorrelation

Autocorrelation exists when the error terms in the population are correlated with each other. This is a common problem with time-series regressions such as the model used in this study. In order to test for the presence of autocorrelation, the Durbin-Watson statistic will be analyzed.

The Durbin-Watson statistic is determined by dividing the squared difference of the residuals by the squared residuals. Calculations for the statistic can be seen in the appendix. The calculated statistic for the model is 2.17 which is in the range of 1.66 to 2.34, which means no autocorrelation is detected. Therefore, the model does not have a problem with autocorrelation. That is, the error terms of the population are not correlated with each other.

The model stood up to all statistical tests, therefore, the results they yield are reliable. Therefore, conclusions can be made as to what the results actually mean.

Section V.

Conclusions

During the time period of 1966 through 1990, the labor force participation rate of women increased and more than offset a small decrease in the labor force participation rate of men. This caused an increase in the labor force

participation rate as a whole. The main purpose of this study was to examine the effects of the increase in labor supply over this time period. In order to make conclusions about the "real wage-labor force participation rate" relationship it is necessary to refer to the results of the regression which indicated the F-LFPR/LFPR is negatively correlated to real wage and highly significant. The implications of this finding are profound.

This negative correlation shows that variables other than labor demand linked variables (such as productivity) can at times have a significant influence on real wages. To truly show this, the model included some labor demand variables such as the annual percentage change in GDP and the annual percentage change in output per worker. The highly significant negative correlation of the supply variable (F-LFPR/LFPR) showed that labor demand linked variables are not the only significant variables in influencing wages. Furthermore, the results indicate that during the time period of the study, larger increases in the female supply of labor relative to the labor force participation as a whole had a negative affect on wages. Therefore, it seems, that large increases in supply can have a great influence on wage structure as hypothesized.

One reason for the negative relationship between real

wages and the increase in the female labor force participation rate is pay inequality. Many researchers have noted that employers often pay women less for the same work. As more women begin to work in the same jobs as men, the lower pay for women could drag down the average pay scale. Since the independent variable in the model is the annual percentage change in average real wage, pay inequality could factor into the decline in the average real wage, caused by increased female labor participation.

A second reason for the negative correlation is because of increased labor supply. Basic theory indicates that surplus labor will drive down wages. As the participation rates increased, a greater supply of labor was added to the economy and caused downward pressure on wages.

In developing nations, labor supply changes seem to be occurring as countries move away from agriculture. As labor supply shifts occur, wages can be influenced. This study shows that as certain areas of the labor force increase relative to the labor force as a whole, negative pressure is placed on wages. This can cause disparity and developing economies may want to consider the effects of industry restructuring. However, supply is not the only area studied in this paper. Strong conclusion can be made about productivity and GDP as well.

The model showed strong positive correlations between real wages and the annual percentage change in average output per worker. This confirms the fact that wages are positively affected by increases in average productivity and supports the marginal revenue product theory of labor. This gives the American worker hope and incentive to perform better on the job. Furthermore, as technology increases, so does productivity and efficiency. This result indicates that as technology rises, pay scales should as well, all else being equal.

The percentage change in GDP from year to year was shown to be a highly significant variable in explaining changes in real wages. From the results of the model we can conclude that as business booms, wages should rise, and in times of recession, wages should fall. This is consistent with business cycle theory and was no surprise.

The results of the regression showed that real wages can be affected significantly by fluctuations in labor supply and demand linked variables. While the results of this study show that larger increases in the female labor force participation rate relative to labor force participation as a whole has a negative affect on real wages as hypothesized, more could be done in this area.

Although the negative relationship between F-LFPR/LFPR

and real wage has been established, the exact reason for the outcome has not. More studies may be conducted on, for example, pay inequality to determine how important of a factor that may be on negative pressures asserted on average real wages. Furthermore, other time periods may be examined to demonstrate the robustness of this relationship. During the time period examined the data indicated both female labor force participation rate and the labor force participation rate as a whole increased, with the female labor force participation rate increasing at a faster rate. Other time periods may be studied during which both are decreasing or moving in opposite directions.

Another area of labor supply that could be examined is immigration. Large increases in foreign workers may have a similar affect on real wages that increases in female participation rates do. Immigration restriction is a highly debated topic and new research may add a different perspective to the debate.

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SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.89690488
R Square	0.80443837
Adjusted R Square	0.77650099
Standard Error	0.00873451
Observations	25

ANOVA

	df	*SS*	*MS*	*F*
Regression	3	0.006590311	0.00219677	28.7943427
Residual	21	0.001602126	7.6292E-05	
Total	24	0.008192438		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.04332385	0.024787515	1.74780921	0.0951047
F-LFPR/LFPR	-0.09998246	0.030121933	-3.31925789	0.00325983
Change Output	0.7794543	0.115750723	6.73390436	1.1593E-06
Change GDP	0.2110646	0.039807605	5.30211763	2.9472E-05

	Real Wage	*Change Output*	*Change GDP*	*F-LFPR/LFPR*
Real Wage	1			
Change Output	0.629725402	1		
Change GDP	0.416657995	-0.183145305	1	
F-LFPR/LFPR	-0.429950099	-0.119688062	-0.005506549	1

SUMMARY OUTPUT Top 40%

Regression Statistics	
Multiple R	0.8659792
R Square	0.74992
Adjusted R Square	0.62488
Standard Error	0.0105273
Observations	10

ANOVA

	df	*SS*	*MS*	*F*
Regression	3	0.001993974	0.0006647	5.9974416
Residual	6	0.000664942	0.0001108	
Total	9	0.002658916		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.1401461	0.104739631	1.3380428	0.22936
F-LFPR/LFPR	-0.230658	0.14508185	-1.589849	0.1629713
Change output	0.6266255	0.218086024	2.8732949	0.0283048
Change GDP	0.2416774	0.08618685	2.80411	0.0309957

SUMMARY OUTPUT Bottom 40%

Regression Statistics	
Multiple R	0.9066509
R Square	0.8220158
Adjusted R Square	0.7330238
Standard Error	0.0056561
Observations	10

ANOVA

	df	*SS*	*MS*	*F*
Regression	3	0.000886513	0.0002955	9.2369549
Residual	6	0.000191949	3.199E-05	
Total	9	0.001078462		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.1317819	0.120180226	1.0965355	0.3148929
F-LFPR/LFPR	-0.192103	0.136038371	-1.412123	0.2076166
Change output	0.632235	0.204650917	3.089334	0.0214061
Change GDP	0.1335052	0.059606126	2.2397903	0.0663662

Calculated F-Stat **0.28867058**

Critical F-Value **3.18**

No Heteroscedasticity Detected

Residuals		
0.005925003		
-0.002556807	Squared Difference	0.003479302
0.005323686		
0.009312653	Squared Residuals	0.001602126
0.004201265		
-0.013185323	Durbin-Watson Stat	2.171677671
0.014717741		
-0.008961038		
-0.013644652		
0.001471759		
-0.007048825		
-0.001506721		
0.008649786		
-0.005409251		
-0.017963527		
0.001572407		
0.005166182		
-0.001355717		
0.002302181		
0.009213164		
0.001489252		
-0.009643493		
0.001762435		
0.002022933		
0.008144909		