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## The Gettysburg Economic Review, Volume 8, Spring 2015

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# The Gettysburg Economic Review, Volume 8, Spring 2015

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The Economics Department and Omicron Delta Epsilon congratulate **Shannon Brobst**, winner of the *2015 Dwight D. Eisenhower Society / R.M. Hoffman Family Memorial Prize in Economics*. The Eisenhower/Hoffman Prize is awarded to the economics student writing the best quantitative paper or project with public policy implications.

The Economics Department and Omicron Delta Epsilon congratulate **Thomas Segerstrom** and **Huyen Do** for receipt of a *2015 Mellon Grant*.

The Economics Department and Omicron Delta Epsilon congratulates Maya Thomas, winner of the *2015 Dr. and Mrs. William F. Railing Fellowship for Faculty-Student Research in Economics*.

The Economics Department and Omicron Delta Epsilon congratulate **Kelsey Chapman** and **Humenghe Zhao** for their induction into Phi Beta Kappa. Phi Beta Kappa celebrates and advocates excellence in the liberal arts and sciences. Its campus chapters invite for induction the most outstanding arts and sciences students at America's leading colleges and universities.

*The Economics Department and Omicron Delta Epsilon congratulate the following students for their achievements in the 2014-2015 academic year:*

**Economics Graduation Banner Carriers:**

**BA: Kelsey Chapman**

**BS: Humenghe Zhao**

**2015 Economics Honors Graduate:**

**Shannon Brobst**

Omicron Delta Epsilon would also like to thank our outgoing officers, **Christopher Fassnacht**, **Connor McMahon**, and **Peter Standbridge**.

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# **Economic Development and Female Labor Force Participation in the Middle East and North Africa: A Test of the U-Shape Hypothesis**

*By Kelsey Chapman*

## **Abstract:**

This paper investigates the relationship between economic development and female labor force participation in the Middle East and North Africa (MENA). Using a panel data set of 20 countries in the region for the period of 1990-2012, I develop an econometric model that tests the U-shape hypothesis. This study builds upon previous literature examining the U-shape hypothesis in time series studies for developing countries, and cross-country studies. The results of this paper suggest that there is a U-shaped relationship between economic growth and female labor force participation rates. The MENA region's low female labor force participation rates can be explained in part by their transition towards the bottom of the U-shaped curve.

## **I. Introduction**

The Middle East and North Africa (MENA) region has the lowest female labor force participation rates in the developing world (Verme, 2014). Despite moderate economic growth, gains in female education, and drops in fertility rates, female labor force participation rates have stayed incredibly low in the region. In some cases, the participation rates have even fallen over the past few decades, as is the case in Morocco. Are countries in the MENA region just at the turning point of the U curve, or are there other unknown factors at play?

Understanding the relationship between economic development and female labor force participation is important for a variety of reasons. The U-shape hypothesis suggests that there is a sort of tradeoff between

gender equality and economic growth during a country's development. Studying this relationship is important for academics and policy makers alike to identify trends in labor force participation and to design and implement policy to that end.

Prior research has established a U-shaped relationship between female labor force participation and economic development. There is a considerable amount of literature that has provided cross-country evidence for the hypothesis (Boserup, 1970; Durand, 1975; Psacharopoulos, 1989; Kottis, 1990; Goldin, 1995; Tam, 2011), as well as time series studies for developed countries such as the United States (Goldin, 1995). Few papers have tested the U-shape hypothesis within the context of developing regions and countries, however (Tansel, 2001). Even fewer have done econometric research focused specifically on the MENA region (Verme, 2014; Tsani, 2012). Recent papers studying the U-shape hypothesis have utilized more sophisticated econometric methods and have found less robust evidence for the hypothesis (Gaddis, 2013; Verme 2014).

In the next section of this paper I will discuss the theory and evidence behind the U-shape hypothesis. After that I will describe the model used, derived from previous literature (Gaddis, 2013; Verme, 2014). In the following section I will describe the data collected to test the U-shape hypothesis. In the final sections I will present my results, limitations and conclusions.

## **II. Literature Review**

The U-shaped hypothesis states that at the beginning of economic development, when agriculture dominates the economy, more women participate in the labor force. Typically fertility rates are still high, but most women have the ability to work and raise children by working on their family farms or by creating household businesses. As a country's economy undergoes structural changes and transitions from agriculture to industry though, women's labor force participation rates tend to fall. Women are unable to take advantage of work opportunities in formal and industrial sectors during the early stages of economic development. Fertility rates are still high, but the move from agriculture to industry limits their ability to work and raise children, lowering labor force participation. Women are also restricted from entering the labor force because of lower levels of female education. In fields that require heavy manual labor, social stigma against female workers lowers the labor force participation rate as well. Consistent with basic labor economic theory, as there is an overall increase in productivity and family earnings, there is a negative income effect on female labor supply (Gaddis, 2013).

In later stages of economic development, as female education increases, fertility rates decline, and socio-cultural attitudes evolve, the participation rate increases (Goldin, 1995). The emergence of white-collar sectors provide new employment opportunities for women that are not subject to the same social stigmas. Moreover, increasing access to childcare facilities and the availability of part-time jobs allow women to work

outside the home while raising children. By this point, the substitution effect leads to higher potential female wages which overcomes the income effect, raising female labor force participation as income per capita rises (Gaddis, 2013).

Cross-country studies have found consistent evidence for the U-shape hypothesis. Goldin (1995) found that the relationship held for a group of about 100 countries in both 1980 and 1985. Mammon and Paxson (2011), using data from 90 countries from the 1970s to the 1980s, also found similar evidence. Psacharopoulos and Tzannatos (1989) looked at a set of 136 countries between 1960 and 1980 and also found a U-shaped relationship. They argue that high and low income countries have the highest female labor force participation rates. Tam (2011), found similar results using panel data for a set of 134 countries from 1950-1980.

Goldin (1995) also examined time-series data for a study on the United States and found evidence for the U-shape hypothesis. Female labor force participation fell during the early stages of economic growth and rose later as development continued. Similar results were found by a study done by Tilly and Scott (1987) for England and France, other developed nations. There are fewer studies on developing countries due to a lack of data. Tansel (2001), examined time series evidence on provinces in Turkey and found evidence for the U-shaped hypothesis.

Gaddis (2013) found less robust evidence for the U-shape hypothesis testing both a static (OLS and fixed effects) model and a

dynamic (autoregressive) model. This paper used cross-country data from 1980-2005 and found that the results for the U-shape hypothesis were very sensitive to the data source used. The study also found little support for the structural change hypothesis from agriculture to industry as an explanation for low female labor force participation on the declining side of the U curve. The paper did find that fertility and education had a role in explaining the rising side of the U curve. Gaddis (2013) also estimated separate regressions for OECD and non-OECD countries and found no evidence for the U-shaped relationship among non-OECD countries. They concluded that, “while it remains possible that today’s advanced economies transitioned through the U over the course of their economic development, the U-shape seems to have little relevance for most developing countries today” (Gaddis, 2013 pp. 26).

To the best of my knowledge, only two papers have examined the U-shape hypothesis in the MENA region, Tsani (2013) and Verme (2014). Tsani (2013) tested the U-shape hypothesis and region-specific effects for the MENA and used the resulting coefficients to compute a general equilibrium model. The paper used data from the International Labour Organization and the World Bank. The model employed used control variables for education, fertility, urbanization, religious norms, and unemployment rates. The estimation results were robust with the control variables, and found evidence for the determinants of female labor force participation rates as well as the U-shape hypothesis.

Verme (2014) divided analysis between parametric and nonparametric evidence using data collected from the International Labor Organization and the World Bank. The researcher's nonparametric evidence showed that the U-shape hypothesis held both worldwide and within the MENA region itself. The paper suggested that MENA countries are at the turning point of the U-shaped curve, explaining their low female labor force participation rates. The parametric evidence did not hold as strongly though, with some countries in the region showing non-significance or even an inverted U-shape. The paper used a model similar to Gaddis (2013) and also suggested that the U-relationship had little relevance for developing countries.

The literature also provides a full discussion of the determinants of labor force participation, the pillars of the U-shape hypothesis. Labor force participation decisions seem to be jointly determined by the individual women and their households as well as by overall market conditions. Education has a positive effect on female labor force participation, by increasing the potential earnings made by the women as well as increasing the opportunity cost of not working (Tsani, 2013; Tansel, 2001). Also, higher education rates are usually accompanied by lower fertility rates which can increase female labor force participation. Fertility itself is expected to have a negative correlation with female labor force participation (Lin, 2011). As socio-cultural attitudes change and women's productive versus reproductive roles are valued, more and more women enter the labor force.

The literature suggests that female labor force participation is affected by economic growth, unemployment and urbanization. The effects of unemployment can sometimes be ambiguous. The higher the unemployment rate, the less likely a women will be able to find a job (even as opposed to a man in the MENA). The “discouraged worker” hypothesis implies that unemployment has a negative effect on labor force participation (Tsani, 2013). The degree of urbanization may affect the number of jobs available to women. Urban areas tend to have more employment opportunities, and can sometimes be more liberal in terms of socio-cultural attitudes. Thus, the greater number of urban areas in a country, the higher female labor force participation will be (Tsani, 2013).

### III. Model

As discussed in the previous section, there is a considerable amount of evidence to suggest the U-shaped relationship between economic development and female labor force participation rates using cross-sectional methods. Typically GDP per capita is used as a proxy for economic development. The model used in the literature to test the hypothesis has been:

$$FLFPR_i = \alpha + \beta_1 \ln y_i + \beta_2 (\ln y_i)^2 + u_i$$

$Y_i$  is GDP per capita, with  $i$  acting as a subscript for countries. The U-shape hypothesis holds if the estimated coefficients are as follows:  $\beta_1 < 0$  and  $\beta_2 > 0$ . This is a simple cross-country equation and is applied to one point in time in the literature.

With more data, allowing for panels to be created, the model has also been transformed to:

$$FLFPR_{it} = \alpha + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + u_{it}$$

This is still a cross sectional model, because the coefficients only measure the average change in female labor force participation rates as GDP changes. This model ignores time and country specific effects, but has been used in the literature to find evidence for the U-shape hypothesis. The OLS estimator is incredibly biased without correcting for time-invariant heterogeneity.

A more appropriate model uses a fixed effects estimator, which controls for country specific effects (Gaddis, 2013; Verme, 2014).

$$FLFPR_{it} = \alpha_i + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + \delta_t + u_{it}$$

This controls for time-invariant, country factors effecting female labor force participation.  $\delta_t$  is the fixed effects. This model is still not optimal, because if female labor force participation does not vary much over time, lagged female labor force participation is correlated with the error term. The regressors are most likely endogenous as well, introducing further issues. A linear dynamic panel data model could correct for these issues but such methods are beyond the scope of this paper. Estimation using instrumental variables and Two Stage Least Squares could also be used. but proper instrumental variables were not found.



This paper's model will be similar to the ones used by Gaddis (2013), and Verme (2014), but will use the control variables provided by the model employed by Tsani (2013).

$$FLFPR_{it} = \alpha_i + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + \beta_3 educ_{it} + \beta_4 fert_{it} + \beta_5 unem_{it} + \beta_6 urban_{it} + \delta t + u_{it}$$

The added variables include controls for education, fertility, unemployment, and urbanization. A time trend is also included. For the U-shape hypothesis to hold, I would expect  $\beta_1 < 0$  and  $\beta_2 > 0$ . For the control variables, I would expect the coefficients on education and urbanization to be positive, and the coefficients on unemployment and fertility to be negative. These results would be consistent with the arguments made in the literature which were discussed in the previous section.

#### **IV. Data**

Data for all of the variables was collected from the World Bank's World Development Indicators database. Female labor force participation is defined as the number of females aged 15 and up who are in the labor force divided by the total female population. Economic growth is controlled for using GDP/capita in current U.S. dollars. GDP per capita is the gross domestic product divided by the midyear population of the country. The control variable for education used was the percentage of female students in secondary education. This is defined as the total number of females in secondary school over the total number of students enrolled in secondary education. Fertility was controlled for using the fertility rate

in each country. The total fertility rate is the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children during that time. Unemployment rates are defined by the share of the labor force that is without work and is available and seeking employment. Urbanization is controlled for with the urban population percentage, or the total number of people living in urban areas over the total population of each country (World Bank).

The econometric approach used pooled panel data for a set of 20 countries for the period of 1990-2012. This is the same data used by many of the cross-country studies reviewed in the previous section. The data set is an unbalanced panel, with several observations missing over different variables, countries, and years. The reasons for some of the missing observations might be correlated with the idiosyncratic errors, which could lead to biased and inconsistent estimators. Collecting data in the MENA region has always been fraught with difficulties though, and there is no available data set or method to account for these missing observations.

**Table 1 – Summary statistics**

<b>Variable</b>	<b>Observations</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<i>FLFP</i>	460	24.64	11.23	9.20	58.10
<i>GDP per capita</i>	432	10,323.71	13,946.88	283.58	92632.68
<i>%females secondary education</i>	352	47.32	4.10	26.04	53.26
<i>Fertility rate</i>	460	3.45	1.30	1.50	8.67
<i>% urban population</i>	460	70.98	17.83	20.93	98.95
<i>% unemployment</i>	440	10.39	6.23	0.30	30.7

There is wide heterogeneity across MENA countries in terms of GDP per capita and urbanization rates. There is quite a difference between the Gulf region (Saudi Arabia, Qatar, Kuwait, and the United Arab Emirates), and the rest of the MENA. This could complicate estimation of the regression model, with the outliers biasing the coefficient estimates, but with such a small sample of countries over time, observations should not be dropped.

## V. Empirical Results

Results for the regression estimated by OLS are shown in Table 2. The regression output confirms the U-shape hypothesis, with similar results to those found in the literature. The GDP per capita variables are both statistically significant, with  $\beta_1 < 0$  and  $\beta_2 > 0$ . In the past, results from this type of estimation have been used as evidence for the U-shape hypothesis, but as stated previously, pooled OLS estimation is biased in the presence of unobserved, time-invariant effects.

**Table 2 – OLS Regression**

Variable	Coefficient	Standard Error
<i>GDP/capita</i>	-22.76***	4.80
<i>GDP/capita</i> <sup>2</sup>	1.58***	0.27
<i>Education</i>	-0.84***	0.13
<i>Fertility</i>	-2.02***	0.43
<i>Urbanization</i>	0.14***	0.05
<i>Unemployment</i>	-0.29***	0.08
<i>Time trend</i>	-0.18***	0.07

Significance level: \*\*\*=.01; \*\*=.05; \*=.1

The results for the fixed effects estimation of the model are shown in Table 3. The econometric estimation also confirms the U-shap hypothesis on the relationship between economic growth and female labor force participation with  $\beta_1 < 0$  and  $\beta_2 > 0$ . The coefficient estimates are statistically significant for both GDP per capita variables. A period of 22 years may be too short to observe a full U-shape but the results suggest that there is one. The within  $R^2$  of the model was 56%. This is the amount of time variation in  $y_{it}$  that can be explained by the time variation in the explanatory variables.

**Table 3 – Fixed Effects Regression**

Variable	Coefficient	Standard Error
<i>GDP/capita</i>	-10.96***	2.51
<i>GDP/capita</i> <sup>2</sup>	0.55***	0.13
<i>Education</i>	-0.63***	0.11
<i>Fertility</i>	-2.34***	0.34
<i>Urbanization</i>	0.05	0.10
<i>Unemployment</i>	-0.10*	0.05
<i>Time trend</i>	0.25***	0.05

Significance level: \*\*\*=.01; \*\*=.05; \*=.1

The coefficient on fertility rates was found to have a statistically significant, negative effect on female labor force participation, in line with theory from the literature. Unemployment rates also had a statistically significant negative effect, although the magnitude of the coefficient was quite small. The coefficient on urbanization was not statistically significant and had a small positive effect on female labor force participation.

The coefficient estimate on education is the most puzzling, having a negative sign and implying that increased education leads to

lower female labor force participation rates. This may be explained by the fact that although secondary education rates have increased dramatically over the past 30 years, this has not translated into increased labor force participation. Female labor force participation rates have remained stagnant despite gains in secondary and tertiary education for women in the MENA region (Verme, 2014).

The most important assumption for using fixed effects is the strict exogeneity assumption. This holds if the idiosyncratic error in each year is uncorrelated with the explanatory variables in all time periods. Using fixed effects, we allow some variables to be correlated with unobserved effects that are constant over time. It is probably not reasonable to assume that the dependent variables are uncorrelated with the errors. Strict exogeneity can be overcome if enough time-varying factors have been controlled for, but clearly there are more variables effecting female labor force participation that are not included in the regression model. These include variables to control for gender and social norms, which have been shown in qualitative research to have an important impact on female labor force participation.

The other assumptions needed to estimate using fixed effects are that the errors in the regression are homoscedastic and serially uncorrelated. Testing for serial correlation there is strong evidence of serial correlation in the errors ( $p\text{-value}=0.00$ ). This means that the test statistics for the estimated regression are invalid. It is difficult to test for serial correlation after fixed effects estimation, but the time-demeaned errors can be used for all of the usual tests.

Testing for hetroskedasticity, there is also strong evidence that it exists (p-value=0.00). With the presence of heteroskedasticity and serial correlation, I applied fixed effects to a cluster sample. Each country, or cross-sectional unit is treated as a cluster of observations over time. Serial correlation, and changing variances are allowed for in each cluster. Using this approach, the standard errors are raised across all of the explanatory variables, as seen in the regression output in Table 4.

**Table 4 – Fixed Effects Regression with robust errors**

Variable	Coefficient	Standard Error
<i>GDP/capita</i>	-10.96**	5.16
<i>GDP/capita</i> <sup>2</sup>	0.55*	0.27
<i>Education</i>	-0.63**	0.23
<i>Fertility</i>	-2.34***	0.66
<i>Urbanization</i>	0.05	0.22
<i>Unemployment</i>	-0.10	0.08
<i>Time trend</i>	0.25*	0.14

Significance level: \*\*\*=.01; \*\*=.05; \*=.1

The GDP per capita coefficients were still statistically significant, as well as the coefficients for the time trend, education and fertility variables. The coefficients for urbanization and unemployment were not statistically significant after using robust standard errors.

This method still does not properly account for the fact that lagged female labor force participation is correlated with the error term. GDP per capita is an endogenous variable, and there is a feedback loop between female labor force participation rates and GDP per capita which biases the coefficient estimates. A linear dynamic panel model using Generalized Method of Moments (GMM) with instrumental variables can accommodate

for endogeneity and autocorrelation. Past papers have used this method, but it is beyond the scope of this paper. Two Stage Least Squares could also be used to account for the endogeneity of GDP per capita, but a proper instrumental variable could not be found.

## **VI. Conclusions**

This paper looked at the relationship between female labor force participation and economic growth in the MENA region. It has done so by using a fixed effects model with control variables for education, fertility, unemployment, urbanization and a time trend. The econometric results provided evidence for the U-shape hypothesis in the MENA region. There is wide heterogeneity across MENA countries, but it was still possible to establish a relationship between female labor force participation and economic growth over the time period analyzed.

The MENA region has made significant strides in reducing gender gaps in human development over the past few decades. This has not translated into improvements in female labor force participation, however (Verme, 2014). This suggests that there might be other factors discouraging women from participating in the labor force. Understanding the relationship between economic development and female labor force participation will help isolate in which areas the MENA region lags behind the rest of the developing world in terms of getting more women into the work force. This paper's results suggest that part of the region's low female labor force participation rates can be explained by its transition towards the bottom of the U-shaped curve.

There were three problems with the estimated model, however. One, it only examined a short period of time. Data on most explanatory variables is only available starting in 1990 and this may be too short of a time period to observe a U-shaped transition. Until longer time series are made available for the region, this is not an issue that can be solved. The second problem with the model employed in this paper is that it did not control for another main pillar of the U-shape hypothesis, social and cultural norms relating to gender. These are important factors, but at the moment there is a lack of data relating to cultural factors to explain female labor force participation. Historically determined, initial factors may be more important in determining labor force participation rates as well. Without having the proper control variables in place for things like culture and gender norms, it may not be possible to properly estimate the relationship between economic development and female labor force participation rates. The final problem with the model employed is that it didn't fully correct for endogeneity, serial correlation, and heteroskedasticity. Without controlling for these issues, the results are less than trust worthy.

Finally, finding a statistically significant U-shaped relationship in cross-sectional analysis across countries does not mean that the relationship holds across individual countries (Gaddis, 2013). A limitation of past research, and of my research, is that cross-sectional models have been used on panel data. As Gaddis (2013) points out, "Data on female labor force participation from countries at different income levels are used to infer the relationship within a single country over time" (pp.12). The



U-shape hypothesis is about changes over time in an individual country, and cross-sectional results shouldn't be an adequate test of the hypothesis. Until longer time series become available for countries in the MENA region, the U-shape hypothesis cannot be properly tested.

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# **Effects of Husband's Education on Wife's Earnings: The Recent Evidence**

*By Humenghe Zhao*

## **Abstract**

This paper aims to examine the relationship between husband's education and his wife's earnings. The study builds upon previous literature revolving around the relationship between a woman's human capital and her husband's earnings. Using pooled cross-sectional data from the Current Population Survey (CPS), I adjust the OLS wage model to estimate whether a man's human capital has positive effects on his wife's earnings. Two major hypotheses concerning the correlation between spousal education and earnings are cross-productivity effect between couples and assortative mating. Using the original regression model, I also estimate a sub-sample designed to restrict the effects of positive assortative mating. Finally, the result suggests that there is strong evidence for the positive effect of husband's education on his wife's earnings.

## **I. Introduction**

Human capital is the stock of an individual's skills, knowledge, abilities that can be used to produce economic value. It is widely recognized that formal education is an important way to obtain human capital, and thus labor-market productivity through providing specific skills and improving one's ability to acquire and process information, to understand changing conditions, and to respond effectively (Becker 1964). Human capital is also highly influenced by interaction with surrounding people, like family and peers through sophisticated conversations, developing strategies and coping mechanisms. Marriage, as one type of association, can provide greater incentives to share acquired abilities and knowledge within the

household (Benham 1974). To the extent that this is true, not only an individual's own formal education and working experience contribute to the individual's effective stock of acquired abilities and productivity, but also the spouse's education has important impact on one's own economic outcomes, such as earnings. In this paper, I intend to explore the effect of husbands' human capital on the productivity and earnings of married women, and the change of the effect over the past ten years.

Regarding the impact of spousal education, a large number of studies were conducted on the effect of a woman's human capital on her husband's earnings. The result of Benham's (1974) study suggests that a wife's education has a positive effect on her husband's earnings. Jepsen (2005) also finds this effect significant from year 1960 to 2000, but with a diminishing magnitude over time. Kenny (1983), Wong (1986), Lam and Schoeni (1993), and Lefgren and McIntyre (1996) all reach the similar conclusion that spousal education has a positive impact. However, despite numerous studies of the effect of wife's education on her husband's earnings, only few studies have examined the effect of a man's human capital on his wife's earnings (Huang et al. 2009, Mano and Yamamura 2010). Although the husband's human capital has been examined as one of the significant determinants of the labor supply of married women, its effect on human capital and earnings of wives has been largely neglected. As the labor force participation of married women has expanded rapidly over the last 30 years, it is of great importance to explore important factors within the household that may give rise to this rapid growth.

There are two major hypotheses that have been used to interpret the positive correlation between spousal education and a person's own earnings. First, the cross-productivity hypothesis argues that the positive effect is due to one's investment in the spouse's human capital. Second, the assortative mating hypothesis argues that the positive effect results from the fact that better-educated individuals marry more productive individuals (Becker 1974). My interest of study is the cross-productivity theory, but these two interpretations are difficult to separate. As will be discussed in detail later, I would use a sub-sample to control for the effects of positive assortative mating.

This paper will proceed as follows. Section II will briefly review previous literature regarding the similar topics. Section III will introduce the human capital theory and the specific econometric model employed to exam the hypothesis. Section IV is devoted to the data and measurement issues and the data set used in the research. Section V discusses the results of OLS regression and hypothesis test and also provides some analysis on the results. Section VI summarizes our findings and implications.

## II. **Literature Review**

Benham(1974) is the pioneer in studying the effect of spousal education on one's earnings. In his paper, he brings up that an individual's effective stock of acquired abilities will be a function of not only his/her own formal education and job experience but also the spousal education. He builds a model based on traditional human capital theories, where the

household is viewed as a firm whose earnings are a function of the effective stock of human capital for each marriage partner. His result suggests that educated women improve the human capital and productivity of their husbands within marriage.

Another early study related to this topic finds that the positive effects of wife's education on the labor market productivity of men are stronger within families who are entrepreneurs in the family business (Wong 1986). More importantly, the study considers both the effects of wife's education on husband's earnings and of husband's education on wife's earnings conditional on the choice of employment status. He also finds evidence that women workers benefit from marrying more educated men.

Jepsen (2005) employs the theoretical basis proposed by Benham. Using United States census data from 1960 to 2000, she finds that a wife's education is positively associated with her husband's earnings, but the magnitude of the effect declines over time. Jepsen adds some new explanation to this contemporary trend by conjecturing that the rapid increase in a wife's labor participation reduced her time to improve husband's productivity. If women use their education to further their own careers, the positive association of a wife's education with her husband's earnings might not exist today; but no direct evidence was provided. She also brings up that recent studies suggest that a person's own education serves a two-fold purpose – increasing human capital and signaling productivity to potential employers.

Lam and Shoeni(1993) analyze the effects of family background on male labor market earnings in Brazil. They try to identify the magnitude

of the "family background bias" in conventional estimates of returns to schooling and to identify the direct effect of family background on earnings. Slightly different from the studies above, their research is based on a theoretical model of assortative mating and intergenerational correlations in income-related characteristics. Though their focus is different, they also find a positive effect of the wife's education on her husband's earnings of over 5% for Brazil and of 3-4% for the United States.

In some other studies, the husband's human capital has been examined as one of the significant determinants of the labor supply of married women. Gray (1997) finds that a wife's labor force participation is negatively associated with her husband's earnings, but they do not pay direct attention to the wife's educational level. Similarly, based on the quantitative analysis using cross-sectional data from the CPS and the NLSY1979, Papps (2010) suggests that men's education has influence on their wives' working hours, even when holding the wages of both spouses constant, but the impact on earnings is neglected.

The most similar studies of the kind are conducted by Huang et al. (2009) and Mano and Yamamura (2010). Huang et al. successfully disentangles the cross-productivity and assortative mating effects by using Chinese twins data, and they find the importance of both effects in explaining spousal earnings. In particular, the mating effect exists for both husbands and wives, but the cross-productivity effect mainly runs from Chinese husbands to wives. Mano and Yamamura investigates many different factors that influence the labor supply and earnings among married Japanese women between 2000 and 2002, including husband's

education, family structure, co-residence with parents or in-laws, and childcare. Their finding associated with husband's education suggests that educated husbands reduce the labor supply of wives, but they tend to improve productivity and earnings of the wives once they participate in the labor market.

One key similarity among all the studies concerning the role of spousal education in one's own labor-market productivity is that they all come to the conclusion that spousal education has significant and positive impact on one's own earnings. Benham(1974), Jepsen (2005), Kenny (1983), Wong (1986), Lam and Schoeni (1993), and Lefgren and McIntyre (1996) all find evidence for the positive impact of wives' education on husband's earnings, while Huang et al. (2009) and Mano and Ymamura (2010) also find positive relationship between husbands' education and wives' labor-market productivity. The primary difference is that previous studies employ different methods of analysis. For example, Benham(1974), Jepsen (2005), and Mano and Ymamura (2010) use the OLS wage model based on Mincer's work(1974); while Wong(1986) and Grossbard-Shechtman and Neuman(1991) also use Two-Stage Least Squares as a method to estimate a system of two equations: earnings and education of the wife. Using Chinese twins data, Huang et al. are able to use fixed-effects model to control for the mating effect.

Most of the previous works use data before 2000s. This paper contributes to the literature by revisiting Benham's OLS wage model using Current Population Survey data from 2003, 2004, 2013 and 2014. Moreover, this paper is the first to explore the association of the husband's



education with his wife's earnings using most up-to-date data. Using pooled cross-sections rather than simple cross-sectional data, my analysis is also slightly different from previous literature as an interaction term is added to the model to explore the change of the effect over the past ten years. In later discussion, I also make a comparison of the effect of the husband's education on his wife's earnings from my study to the effect of the wife's education on her husband's earnings from previous literature. The discussion of such comparison can help us facilitate a better understanding of the contemporary role of female in the labor force and family.

### III. **Modelling**

One explanation for the higher earnings of individuals married to more educated spouses is that their spouses enable themselves to enhance their own human capital and, therefore, their productivity and earnings. The term "cross-productivity effect" is used to describe the contribution of a spouse's human capital to own productivity. As stated in the cross-productivity hypothesis, within households consisting of only married couples, the effective stock of human capital for the wife is a positive function of the individual stock of human capital of each spouse (Benham 1974). That is,  $h_t$  is the effective stock of human capital for the wife at time  $t$  and the indexes  $w$  and  $h$  represents wife and husband respectively. The individual is viewed as a firm whose earnings at time  $t$  are a function of the individual's market productivity. The wife's earnings are also a

function of the wife's stock of human capital. Then, in the household that is viewed as a firm composed of husband and wife, the wife's earnings can be expressed as a function of both partners' human capital stock. That is). The first order condition is , which indicates the positive effect of the husband's effective human capital stock on his wife's earnings.

The empirical model used in this paper is based on Benham's(1974) model, which uses a standard Mincer(1974) ordinary least squares wage model to consider the association of the husband's education with his wife's earnings. As will be discussed below, I also added other control variables and an interaction term investigating the change of the effect. Moreover, I used a set of dummy variables describing the wife's education attainment instead of using only one variable of years of schooling. I estimate the following OLS model:

$$\ln(\text{earning})_i = \beta_0 + \beta_1 * \text{eduh}_i + \beta_2 * \text{exp}_i + \beta_3 * \text{exp}_i^2 + \delta_1 * \text{eduw2}_i + \delta_2 * \text{eduw3}_i + \delta_3 * \text{eduw4}_i + \delta_4 * \text{eduw5}_i + \delta_5 * \text{white}_i + \delta_6 * \text{south}_i + \delta_7 * \text{midwest}_i + \delta_8 * \text{west}_i + \delta_9 * \text{urban}_i + \delta_{10} * \text{y1314}_i + \alpha_1 * (\text{eduh} * \text{y1314})_i + \mu_i,$$

where  $\ln(\text{earning}) = \log$  annual earnings of wife in family with wife and husband present,

eduh=years of schooling completed by husband,

exp=years of work experience of wife,

eduw2...eduw5=wife's education attainment modeled as a set of dummy variables,

white, south, midwest, west, urban and y1314 are dummy variables indicate race, region, urban location and time,

(eduh\*y1314) is the interaction term captures the change of the

effect of husband's education on his wife's earnings over the ten years.

The omitted categories are as follows: wife's education—less than high school; race—nonwhite; location—rural, and region—East.

Benham(1974) models the natural log of the husband's annual earnings as a function of the years of schooling completed by the husband, the potential work experience of the husband, and potential experience squared. He also includes a variable for the years of schooling completed by the wife. Built upon this model, I include other variables that may explain the wife's earnings, such as her race and the family's geographic region. By adding these variables, some of the effects of omitted variables can be avoided. One would expect whites to earn more than non-whites and workers in urban areas to earn more than workers in rural areas. Workers in the East are likely to earn more than workers in the Midwest.

By modeling husband's education as his years of schooling, Benham gives equal weight to the difference in schooling between fifth grade and sixth grade as to the difference between the junior and senior years in college. Under the assumption that education increases one's own productivity only by increasing human capital, modeling education as the years of schooling is appropriate. However, more recently, many researchers suggest that "a person's own education serves a two-fold purpose—increasing human capital and signaling productivity to potential employers" (Jaeger and Page 1996). That is, people who have completed a type of degree signal their productivity and ability through their academic credentials. Thus, a person with 16 years of education and a bachelor's degree may be viewed by potential employers as being a

better prospect for employment than someone with 16 years of education but no degree because the person with the bachelor's degree has signaled an ability to complete the task of earning a college degree (Hungerford and Solon 1987). In order to allow for non-linear effects of education, the wife's education here is modeled as a series of dummy variables. The categories of this classification will be described in detail in the data section. The positive effect of the spousal education is explained using a human capital approach (cross-productivity effect), not signaling approach: additional years of schooling allow a husband to acquire skills that help him assist his wife. Then, the husband's education is still modeled as years of schooling.

An alternative explanation for the positive association between one's earnings and spousal education is that individuals with higher earnings are likely to marry partners with more desirable characteristics. This so-called "assortative mating" hypothesis states that people have a tendency to select marriage partners of a similar education level regardless of cross-productivity effects. For example, if men regard education as an asset in the marriage market, then better-educated men may attract and marry better-educated and more productive women (Mare 1991). In econometric language, the cross-productivity effect is the causal effect of spousal education on earnings, but the mating effect is caused by omitted variables. An ordinary least squares estimated of the effect of spousal education on earnings may not show the causal effect because spousal education is likely to pick up one's own ability or the mating effect (Boulier and Rosenzweg 1984). Previous studies employ several different ways to

try to separate the two effects. For example, Benham(1974) differentiates between the years of the wife's education obtained before and after her marriage in an attempt to distinguish between the two arguments. Huang et. al. use fixed effect model with unique Chinese twins data to control for unobserved background and ability factors. In my study, to attempt to control for the marital-sorting effect, I consider a sub-sample using the original regression model. In the sub-sample, only couples who are more than 5 years apart in age are considered in an attempt to focus on people who are less likely to have met their mate in school (Jepsen 2005). However, these two interpretations are difficult to separate even with longitudinal data. My approach can only bring some evidence to bear on this issue, but may not effectively differentiate between the human capital interpretation and the martial sorting explanation.

#### IV. **Data**

The data are taken from the March supplements of the Current Population Survey for year 2003, 2004, 2013 and 2014. Data sets are pooled together; year 2003 and 2004 are treated as one time period, and year 2013 and 2014 are treated as another time period. Households are dropped if either spouse was a member of the armed forces or was not aged 20-60. The earnings variable is the log of the wife's total wage and salary earnings, which is the dependent variable used in previous studies. The data are restricted to wives who work full-time to avoid any earnings effects that would be a result of part-time work status. Dollar levels for each year are converted into 2000-dollar level by the Consumer Price

Index for all items. Potential work experience is estimated as age minus schooling minus six as defined by Benham(1974). The race variables are white and nonwhite; the location variables are urban and rural; the categories for geographic region are East, West, Midwest and South. Five education categories were defined for wives based on the highest grade completed. The categories are less than a high schooling graduate, high school graduate, some college, college graduate, and post-bachelor's degree work. The husband's education is modeled as the continuous variable of years of schooling.

Advantages of the CPS data include very large sample size and most up-to-date data. A disadvantage is that CPS data are cross-sectional rather than longitudinal, which makes it difficult to distinguish productivity effects from assortative mating effects. Another drawback is that the CPS contains no measure of individual's ability. Though modeling the wife's own education as a set of dummy variables can help to pick up one's own ability according to the signaling theory discussed in the modeling section, without using proxies for ability, the positive causal effect of husband's education is still likely to pick up wife's own ability. However, the later result shows that the estimated returns to husband's education using CPS data is similar to those obtained from other data sources in previous literature.

The descriptive statistics of the earnings and education variables are reported in Table1 and reveal changing demographics for married couples over the past ten years. The average years of schooling increase for both husbands and wives from 2003-04 period to 2013-14 period. The

correlation coefficients that measure the degree of correlation between the wife’s schooling and the husband’s schooling are reported at the bottom of Table 1. The correlation are virtually unchanged from 2003-04 to present, which are 0.603 and 0.604 respectively. The size of the correlation coefficients is slightly smaller than the correlations found by Benham(0.65), Shechtman and Neuman(1991) for Israel(0.684) and Wong for Hong Kong(0.65). The correlations provide one measure of the propensity for positive assortative mating with respect to education. That is, the propensity for people with similar educational attainments to marry each other. The correlation statistics suggest that not much has changed during the time period under study (Jepsen 2005).

Table 1. Descriptive statistics

	2003-04		2013-14	
	Mean	Std. Dev.	Mean	Std. Dev.
Wife				
Annual earnings(in 1000)	36.304	34.171	49.723	46.219
Earnings in 2000 dollars	33.460	31.471	36.483	33.943
Years of schooling	13.880	2.72	14.229	2.729
Less than a high school degree	0.050	0.218	0.036	0.187
High school graduate	0.296	0.457	0.214	0.410
Some college	0.298	0.457	0.276	0.447
College graduate	0.235	0.423	0.285	0.451
Graduate/Professional school	0.121	0.326	0.189	0.391
Husband				
Years of schooling	14.127	2.562	14.776	2.642
n	33,188		22,159	
Correlation of wife/husband schooling	0.603		0.604	

## V. Empirical Evidence

Table 2. Regression of log of wife's annual earnings.

Independent Variables	Coefficients(robust Std. Err.)
Husband's Education	0 .0178***
	(0.0021)
Wife's Characteristics:	
High school graduate	0.360***
	(0.016)
Some college	0.536***
	(0.016)
College graduate	0.845***
	(0.017)
Graduate/Professional school	1.084***
	(0.019)
Experience	0.027***
	(0.001)
Experience squared	-0.0004***
	(0.00002)
White	0.032*
	(0.015)
Urban location	0.202***
	(0.007)
Midwest	-0.083***
	(0.0086)
West	-0.056***
	(0.009)
South	-0.088***
	(0.0083)
Year 2013&2014	-0.012**
	(0.006)
Husband's schooling* Year 2013&2014	0.004***
	(0.001)
Adjusted R-squared	0.204
<i>n</i>	55,347

\*\*\*Significant at the 0.01 level

\*\*Significant at the 0.05 level



Table 2 reports the regression results of estimating the econometric model using the full sample. The coefficient of the key variable of interest, the husband's education, is reported in the first row. All of the signs of the coefficient estimates on the variables were found to be in accord with expectations. The coefficient of the husband's education is positive and significant. The simple null hypothesis that education of husband is unrelated to wife's earnings can be rejected. The size of the effect is about 0.0178, which implies that if the husband has one more year of schooling, his wife's earnings would increase by about 1.78 percent holding constant other factors in the model. The magnitude of the effect increases by about 0.4 percent from 03-04 period to 13-14 period. Both the estimated effect of interest and the estimated change of the effect over time are significant at 1% significance level.

In previous studies, the size of the benefit of the wife's education was about 1.5-4%. My estimation of the benefit of the husband's education falls into this range, suggesting that the effect of spousal education on one's own earnings is almost symmetrical. Previous studies mostly focus on the effect from wife to husband and conclude that the wife's education provides substantial labor-market benefits to the family beyond increments to her own earnings. Male dominance in society is assumed when such studies were conducted. However, female labor force participation rate has dramatically increased over the past several decades, and females are playing increasingly significant roles in our society. With respect to this contemporary context, my estimation result provides evidence for such symmetrical effect, as the size of the effect from wife to husband is about

the same as from husband to wife. The slight increase of the effect may suggest that husbands play increasingly important role in contributing to their wives' human capital accumulation. Females are taking more advantage of their marriage than ten years ago.

As expected, Table 2 shows that a woman's own educational attainment is a significant predictor of her earnings. The rate of return to a high school degree is about 36%. The return to some college is larger, about 53.6%. The largest rates of return are for wives with college degrees or higher. The return to a college degree is about 84.5%, and the return to post-college schooling is around 108.4%. However, the issue here is that the estimated returns to education are higher than those in previous studies. The potential reasons will be discussed later in this section. Other variables also have the expected signs. The return to additional years of experience is positive and significant, but declines with age, as the sign of the coefficient for the experience squared variable is negative. White females earn more than non-white females. Workers in the East and West earn more than workers in the Midwest and South. The location of the household also has substantial impact on the wife's earnings, as women who live in urban areas earn about 20% more than women who live in rural areas.

Table 3 reports the results for the model using the sub-sample of wives and husbands who are more than 5 years apart in age. As discussed in the model development section, the purpose of using this sub-sample is to control for the assortative mating effect. This sub sample represents couples who are less likely to have met each other either in high school

or college. The correlation of the husband’s education and his wife’s earnings remains positive and significant in this case. The size of the benefit of husband’s education is slightly higher using this sub-sample. The magnitudes of the coefficients on the wife’s own education are about the same. There is less evidence for the earning premium of being a white, as the coefficient is only significant at 10% level. Also, the change of the benefit of husband’s education increases to about 0.6 percent, but it’s only significant at 10% level.

Table 3. Regression of log of wife’s annual earnings using a sub-sample of couples who are more than 5 years apart in age.

Independent Variables	Coefficients(robust Std. Err.)
Husband’s Education	0 .021***
	(0.0034)
Wife’s Characteristics:	
High school graduate	0.350***
	(0.031)
Some college	0.537***
	(0.033)
College graduate	0.831***
	(0.035)
Graduate/Professional school	1.13***
	(0.038)
Experience	0.034***
	(0.003)
Experience squared	-0.0006***
	(0.00007)
White	0.060*
	(0.017)
Urban location	0.202***
	(0.007)
Midwest	-0.103***
	(0.021)

West	-0.051**
	(0.021)
South	-0.057***
	(0.019)
Year 2013&2014	-0.015**
	(0.007)
Husband's schooling* Year 2013&2014	0.006*
	(0.003)
Adjusted R-squared	0.208
<i>n</i>	11,285

\*\*\*Significant at the 0.01 level

\*\*Significant at the 0.05 level

\*Significant at the 0.10 level

Concerned about the ability of the model to address the research question, I run several diagnostic tests to check the Gauss-Markov assumptions for OLS regression. Issues of heteroskedasticity were present in the model, as evidenced by the Breusch-Pagan Test and White's Test for heteroskedasticity. In response, I employ robust standard errors. Additionally, vif test is used to test for multicollinearity. Except the interaction term, experience and experience squared, all other five variables have vif values smaller than 5, which indicates there is evidence of multicollinearity. Lastly, the p-value of the Ramsey RESET test is about 0.31, so the null hypothesis is not rejected, suggesting that there is no evidence of functional form misspecification.

Although the coefficient estimate of the key independent variable, husband's education, is significant and consistent with other studies, there are still some issues associated with the model and estimation result. The estimated returns to one's own education in my result are substantially higher than those in previous study. In Jepsen's (2005) study, she found

that the return to each level of education is larger in 2000 than in 1960; and the return to a high school degree ranges from 12 to 17%, the return to some college ranges from 19 to 27%, the return to a college degree increases from 38 to 60%, and the return to graduate or professional degree increases from 55 to 98%. One reason might be that returns to education increase over time. Other studies have found increasing returns to education over time. For example, Levy and Murnane(1992) find that returns to education increased from 1960 to 1990 for both men and women. Using more up-to-date data, there are potential increases in the returns to one's own education in my regression result. Another reason could be that there is still omitted variable bias in the model. When modeling wife's own education as several dummy variables, they would not only reflect the returns to different levels of education attainment, but also pick up the effects of signaling one's ability. As discussed above, one drawback of this data set is the lack of proxy variables for one's ability. Then, without explicitly controlling for the wife's own ability, the dummy variables pick up some of the effect of the wife's ability. Regarding the size of the effect of spousal education, this omitted variable problem seems have very little impact on the estimation of my interest of study. This happens because one's own education is more associated with one's own unobserved ability or family background than spousal education, and therefore we see potential positively biased estimates of the returns to own education.

Another limitation is that my method of using a sub-sample may not successfully differentiate between cross-productivity effect and marital sorting effect. The coefficient estimate of husband's education in the

sub-sample is not statistically different from that in the full sample. The indifferent results have two underlying explanations. If marital sorting effect does exist, then after controlling for it, the size of the coefficient estimate is likely to decrease as only cross-productivity effect presents. Under the assumption of having successfully controlled for marital sorting effect, the indifferent results may disprove the existence of marital sorting effect. Another explanation for the indifferent results is that using the sub-sample is not sufficient for teasing out all the assortative mating effect. It only excludes observations with higher potential of having such effect, but the remaining observations may still have both effects. Among all previous studies of related topics, only Huang et al.(2009) empirically distinguish between the cross-productivity and mating effects. Their successful differentiation between the two effects is due to using unique twins data they collected from urban China. However, without such unique data, one can hardly distinguish between the two effects. My approach here can only bring some evidence to bear on this issue.

## VI. **Conclusion**

In this paper, I analyzed the relationship between husband's education and his wife's earnings. According to human capital theory, spousal education helps an individual accumulate human capital and increase earnings. The alternative explanation is the assortative mating effect in the marriage market; that is, those who marry well-educated people are of higher ability. Using data from the CPS, I estimate my hypothesis with the OLS wage model. The result suggests there is strong

evidence for the positive effect of husband's education on his wife's earnings. Using the original regression model, I consider a sub-sample that is designed to restrict the effects of positive assortative mating. The result of this regression is consistent with the results from the full sample. However, omitted variable bias still presents in the model as the use of CPS data cannot effectively control for one's unobserved ability. Moreover, my approach may not fully distinguish between the cross-productivity and marital-sorting effects. Further research concerning this topic may need to find a more effective way to differentiate between the two effects.

In this article, a potential channel of post-school human capital acquisition, learning within marriage, is proposed. The finding that spousal education has effect on one's own earnings could expand our understanding of the theories of human capital, marriage, and the family. Labor-market benefits to women appear to be associated with their marrying well-educated men. These benefits have implications not only for women's earnings but also for the considerations of future marriage partner choice.

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# *Do Living Wages alter the Effect of the Minimum Wage on Income Inequality?*

*by Ben Litwin*

*Anker (2006) proposed a new methodology for calculating the living wage in countries around the world. By looking at OECD nations between 2000-2010, we look to see if countries with a national minimum wage higher than this living wage value see a notable difference in the effect of the minimum wage on income inequality. Our results show that countries with the minimum wage higher than the living wage value do see lower inequality, although there is a key value of the minimum wage, at which countries start to see disemployment effects that increase inequality.*

This paper will focus on the question, does setting the minimum wage equal to or above the living wage impact income inequality? Many people agree that the idea behind the minimum wage is to reduce the poverty rate. Most minimum wage legislation and regulations focus on the idea that those who work, should be able to provide for themselves and their families.<sup>1</sup> This brings up the idea of a living wage, which is the wage that would be able to sustain a person at the lowest standards for an area. Richard Anker (2006) presented a new methodology for calculating the living wage in nations across the world by taking the poverty line in a country, and dividing it by the total hours the average person in that country works, along with accounting for average workers per household, and then adding 10 percent of that value to account for sustainability in the case of unforeseen expenses.<sup>2</sup> To test this model, we will include it into the

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<sup>1</sup> Anker, Richard, 2006, "Living Wages Around the World: A New Methodology and Internationally Comparable Estimates" *International Labour Review* 145 (4): 309-10

<sup>2</sup> *Ibid.*, 318

methods of previous research into the effect of the real minimum wage on income inequality. One of the main models used to look at this relationship is the one presented by John DiNardo, Nicole Fortin, and Thomas Lemieux (1996) who looked at wage differentials and saw how the decline in the real value of the minimum wage increased inequality.<sup>3</sup>

The next section of the paper will look at previous research, not only going more in depth about the results of Anker (2006) and DiNardo et al. (1996), but also more theories behind why the minimum wage could affect income inequality and how the living wage is added into the mix. This will be followed by a section about the methodological plan of this paper, including selection of explanatory, dependent, and control variables. The third section will look at the results of the models, and finally the last section will be a discussion about these results and concluding remarks.

### **Previous Research**

One of the first models to show the effect of the real minimum wage on income inequality was presented by John DiNardo, Nicole Fortin, and Thomas Lemieux (1996) who used a Kernel density function. With the density function, they were able to see that there was a large compression of data at the minimum wage value, implying that the spread of income was being held up at the bottom by the minimum wage.<sup>4</sup> DiNardo et al. compared the wage differentials for the 10<sup>th</sup> and 90<sup>th</sup> percentiles and the 10<sup>th</sup> and 50<sup>th</sup> percentiles, and looked at their change from 1979 to 1988 as

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<sup>3</sup> DiNardo, John, Nicole M. Fortin, and Thomas Lemieux. 1996. "Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semiparametric Approach." *Econometrica* 64 (5): 1002

<sup>4</sup> *Ibid.*, 1002

the real value of the minimum wage dropped by 27 percent.<sup>5</sup> They found that just for the wage differentials in men, “the minimum wage explains 25 percent of the change in the 10-90 differential [and] 66 percent of the change in the 10-50 differential.”<sup>6</sup> These values are even greater when looking at the results presented about women. By using similar methods, we will be able to see if this relationship holds on the international level and is affected by the living wage.

The main theory to explain the relationship between the minimum wage and income inequality is that the minimum wage is a tool for the redistribution of income. Richard Freeman (1996) lays out this theory by showing how other people and corporations pay for higher minimum wages.<sup>7</sup> The theory presented is that there are three different groups that give up part of their wealth to help pay for an increase in the minimum wage, the consumers who pay for goods and services produced by minimum wage workers, the stakeholders in businesses that pay the minimum wage, and low wage workers that lose their jobs due to the higher wages.<sup>8</sup> Although the basic economic theory, such as what is discussed by Scott Adams and David Neumark (2003), would suggest that raising the minimum wage would act as a price floor on labor and reduce its demand, Freeman shows that previous research on employment effects of actual increases to the minimum wage in the United States and the United Kingdom have shown the elasticity of demand for minimum wage workers to be around zero.<sup>9</sup>

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<sup>5</sup> Ibid., 1014

<sup>6</sup> Ibid., 1030

<sup>7</sup> Freeman, Ricahrd, 1996, “The Minimum Wage as a Redistributive Tool.” *The Economic Journal* 106 (May): 640

<sup>8</sup> Ibid., 640-1

<sup>9</sup> Adams, Scott and David Neumark, 2003, “Living Wage Effects: New and Improved Evidence.” *NBER Working Papers* no. 9702: 3 and Freeman, 1996, “The Minimum Wage as a Redistributive Tool,”: 641-2.

Therefore, the groups that mainly pay for higher minimum wages are the consumers and the businesses. This would show that, in theory, increases in the minimum wages take money from some people and redistribute it to others, causing a decrease in income inequality.

David Card and Alan Krueger (1995) also discuss the effect of the minimum wage on the distribution of wages in chapter nine of their book *Myth and Measurement*. After briefly mentioning that recent labor market data gives no support to the standard economic theory that discusses the disemployment effects of the minimum wage, Card and Krueger show how increases in the federal minimum wage halt and temporarily reverse the trend of growing income inequality in the United States over the last 30 years.<sup>10</sup> The effects are only temporary, since in years after the minimum wage increases, the wage gap continues to rise again. Card and Krueger also warn that these changes to the level of income inequality are small since these increases tend to only increase the incomes of the lowest-paid workers by a fairly small amount, usually around 10-15 percent.<sup>11</sup> Therefore the effects tend to seem small, although they are statistically significant.

The other main theory for how the minimum wage affects income inequality is presented by Oren Levin-Waldman (2001) and deals with the overall wage structure. The idea behind his argument is that increases in the minimum wage apply upwards pressure on other low-wages, even if

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<sup>10</sup> Card, David and Alan B. Krueger, 1995, "How the Minimum Wage Affects the Distribution of Wages, the Distribution of Family Earnings, and Poverty," Chap. 9, In *Myth and Measurement*, Princeton, NJ: Princeton University Press, 276-9.

<sup>11</sup> Ibid., 277

<sup>12</sup> Levin-Waldman, Oren M, 2001, *The Case of the Minimum Wage*, SUNY Series in Public Policy, edited by Anne Schneider, Helen Ingram. Albany, NY: State University of New York Press: 32.

they are not directly affected by the statutory increase.<sup>12</sup> By increasing the wages at the lower end of the spectrum, while not having an effect on higher wages, the minimum wage closes the wage gap, thereby reducing income inequality.

Looking more into the living wage, Benjamin Page and James Simmons (2000) present an argument in their book, *What Government Can Do*, that focuses on cities across the United States, such as Baltimore, New York, Los Angeles, Chicago, Boston, and Milwaukee, all of which have passed living wage laws requiring companies with government contracts to pay their employees higher wages so that the workers do not live below the poverty line.<sup>13</sup> The idea behind these living wage laws is that full time employees should not be living in poverty and minimum wages should be high enough to reduce poverty levels. Page and Simmons however do warn that minimum wages that are too high could possibly have a negative impact on employment and economic growth, but so far there has not been a situation among areas with living wage laws where this seems to have happened. All living wage levels have stayed “within the modest ranges” so that they can have “a positive contribution to the average incomes of poor Americans.”<sup>14</sup>

The model of the living wage presented by Anker (2006) is shown in the equation below.

$$\text{Living Wage} = \frac{\frac{\text{Poverty Line}}{\text{Hours worked}}}{\text{Workers per household}} + 10\%$$

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<sup>13</sup> Page, Benjamin I. and James R. Simmons, 2000, *What Government Can Do: Dealing with Poverty and Inequality*. American Politics and Political Economy, edited by Page, Benjamin I. Chicago: The University of Chicago Press: 226

<sup>14</sup> Ibid: 226-7

Anker presents this as a suitable model to find a standard way of calculating a living wage since the living wage is meant to be an “hourly wage rate required to support a household at the poverty line.”<sup>15</sup> Using this definition, Anker created the model being used along with factoring in an additional ten percent to account for unforeseen costs or personal savings for bigger purchases.<sup>16</sup> Anker does discuss whether to use one worker per household or two, since the traditional family includes two working adults, but many low-income families only have one working adult due to the cost of childcare.<sup>17</sup> Therefore we will look at the model using both one worker per family and two workers per family. Finally there are various ways to calculate the poverty line. For a basic measure, we will be using the World Bank’s relative poverty line, which is simply 50 percent of the country’s mean income.<sup>18</sup> Although this is not the most exact measure of poverty, it will be sufficient to calculate a living wage.

### **Methodological Plan and Data**

Using the formula for the living wage previously shown, we will be able to calculate the living wage for OECD nations and then compare this value to the actual federal minimum wage in these countries. This will divide OECD nations into two groups, countries with the minimum wage below the living wage, and countries with the minimum wage at or above the living wage. From this comparison we will be able to create a

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<sup>15</sup> Anker, 2006, “Living Wages Around the World”: 312

<sup>16</sup> Ibid., 318

<sup>17</sup> Ibid., 323

<sup>18</sup> “Choosing and Estimating a Poverty Line,” Poverty Reduction and Equity, The World Bank Group, accessed November 16, 2014, <http://go.worldbank.org/AOCMSD1N30>

dummy variable equal to 1 if the minimum wage is at or above the living wage and 0 if the minimum wage is below the living wage. This will lead to the following regression.

$$WD_{it} = \beta_0 + \beta_1 MW_{it} + \beta_2 LW_{it} + \beta_3 MWLW_{it} + X + u$$

Where  $WD$  is the wage differential being measured,  $MW$  is the minimum wage,  $LW$  is the dummy variable for whether or not the minimum wage is at or above the living wage, and finally there is an interaction term to see if the effects of the minimum wage on the income inequality in countries where the minimum wage is above the living wage is different from other countries.  $X$  represents all other control factors that will be in the model,  $u$  is the error term, and  $i$  represents the different countries while  $t$  represents the different years.

The control factors being used will be modelled after the research of Ximing Wu, Jeffrey Perloff, and Amos Golan (2006) who show the effect of different governmental policies on income inequality in urban and rural areas.<sup>19</sup> Since Wu et al. found a statistically significant difference between urban and rural populations, we will use this as one of our controls, along with the percentage of the population in different age groups, social expenditure, the national GDP, and the unemployment rate.<sup>20</sup> Finally, Card and Krueger (1995) found that the effect that the minimum wage has on income inequality significantly depends on the percentage of the population that would be affected by a minimum wage increase.<sup>21</sup> To

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<sup>19</sup> Wu, Ximing, Jeffrey M. Perloff, and Amos Golan, 2006, "Effects of Government Policies on Urban and Rural Inequality," *Review of Income and Wealth* 52, no. 2

<sup>20</sup> *Ibid.*, 231 for the results of their being a statistically significant difference between urban and rural areas and *Ibid.*, 222 for the list of other control factors.

<sup>21</sup> Card et al., 1995, Chap. 9, In *Myth and Measurement*, 297.

account for this, we will also use the percentage of the population below the poverty line.

As stated earlier, this model will be run using calculations for the living wage with one and two workers per family since the traditional family includes two working members, while many low-income families only have one worker due to the cost of child care. We will also be running separate regressions for the wage differentials for the 90<sup>th</sup> and 10<sup>th</sup> percentiles to measure full inequality, and 50<sup>th</sup> and 10<sup>th</sup> percentiles to measure lower tail inequality. This comes from the methods of DiNardo et al. (1996) since they not only found a compression of wages at the lower tail of the density function, but also big changes in the effect of the minimum wage when just looking at the lower end of the spectrum.<sup>22</sup>

The data for this research will be collected from the OECD database for all variables except for the percentage of the population that lives in urban environments, since the OECD does not keep track of that data. Therefore urban population percentage data will come from the World Bank's database. We will be looking at data from the years 2000-2010 since many of the variables being observed do not have very consistent data points before that period, and some variables do not have any data reported after 2010. Finally, only 25 of the 34 OECD countries have been included in this study since the OECD does not have minimum wage values for the other nine. Therefore Austria, Denmark, Finland, Germany, Iceland, Italy, Norway, Sweden, and Switzerland will not be

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<sup>22</sup> DiNardo et al., 1996, "Labor Market Institutions and the Distribution of Wages."



included in this study due to the inability to compare their minimum wages with the living wage values calculated for them.

We have two main hypotheses for this model. The first hypothesis is that the minimum wage will help reduce income inequality. This is due to the redistributive effects of the minimum wage. Higher minimum wages will lead to more wealth being taken from consumers and businesses, and given to low-income workers, which would result in lower inequality. The second hypothesis is that minimum wages at or above the living wage will have a significantly higher effect on reducing income inequality than countries with lower minimum wages. This is somewhat an extension of the first hypothesis since the countries with minimum wages above their living wage value will have higher minimum wages, but also this hypothesis would provide evidence that the formula for the living wage created by Anker (2006) would be an effective calculation that showed how living wages help improve the relative standard of living for low-income workers in a particular country.

## **Results**

By running the regression for the 90-10 wage differential using panel data methods to control for country and time fixed effects, we find the results shown in table 1. The first column represents the values when the regression is run using one working family member and the second column shows two working family members.

Table 1.  
90-10 percentile wage differentials on variables altering  
calculations for the living wage between one and two  
working adults.

	One working adult	Two working adults
Minimum Wage	-0.0102	-0.0935**
Living Wage Dummy	-0.0000414	-0.350***
Min Wage-Living Wage Dummy	-0.000798	0.0768**
Social Expenditures	0.00002	0.000038
Urban Population	-0.00262	-0.00295
GDP	0.0000001****	0.0000000885****
Unemployment Rate	0.0234***	0.0154*
Poverty Rate	0.202****	0.202****
Population Under 18	3.70*	3.67*
Population 18-40	-0.662	-0.588
Population 41-50	-3.55	-4.76*
Population 51-65	-4.079	-4.55
Population 66-75	4.59	3.075
Population 76 and over	-3.34	-2.88
Constant	2.30*	2.95**

*\*p<0.1 \*\*p<0.05 \*\*\*p<0.01\*\*\*\*p<0.001*

This model shows that the effects of the minimum wage and living wage on income inequality, as measured by the wage differential between the 90<sup>th</sup> and 10<sup>th</sup> percentiles, is highly significant when calculating the living wage using two working adults in the house, while they are not significant when the living wage is calculated using one working adult. Looking closer at the data, this relationship could stem from the fact that there are very few observations where the minimum wage is equal to or higher than the one working adult living wage. Therefore, it is more accurate to look at the relationship while using the two working adult model. This provides evidence that not only do higher minimum wages significantly reduce overall income inequality, but also that the group of countries with minimum

wages at or above the two working adult living wage have significantly less inequality, but the minimum wage is less effective at reducing inequality in these countries, thereby showing that at a certain level, these higher minimum wages will start increasing inequality, as shown by the positive estimate on the interaction term. This was accurately predicted by Page and Simmons (2000), since minimum wages higher than a certain amount could start to have a stronger unemployment effect than redistribution effect.<sup>23</sup> Also, although many of the control variables do not appear to be significant, we found the joint significance of the control variables related to economic conditions (social expenditures, urban population, GDP, unemployment rate, and poverty rate) to be highly significant and the joint significance of the age variables to be highly significant.

Now that we see the influence of the minimum wage on income inequality for the whole population, we can look at the relationship when only looking at the lower tail of the income distribution. DiNardo et al. (1996) found that the minimum wage had a significant effect on overall inequality, but for the lower end of the wage spectrum, changes in the real minimum wage accounted for the overwhelming majority of changes in inequality for men, women, and pooled genders.<sup>24</sup> Expanding on these results, we can see how adding in the effects of a living wage changes this significance, results for which are shown in table 2. Again, the control variables are all jointly significant by group (economic conditions and age variables) even though many of these variables are individually not significant.

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<sup>23</sup> Page et al., 2000, *What Government Can Do*, 226

<sup>24</sup> DiNardo et al., 1996, "Labor Market Institutions and the Distribution of Wages," 1030.

Table 2.  
50-10 percentile wage differential on variables altering  
calculations for the living wage between one and two  
working adults.

	One working adult	Two working adults
Minimum Wage	-0.0111*	-0.081*
Living Wage Dummy	0.064	-0.0505
Min Wage-Living Wage Dummy	-0.00498	0.0117
Social Expenditures	0.00000778	0.00000784
Urban Population	-0.000703	-0.000781
GDP	0.0000000748	0.0000000916*
Unemployment Rate	0.00166	0.000954
Poverty Rate	0.077****	0.0772****
Population Under 18	1.83***	1.69***
Population 18-40	-0.265	-0.268
Population 41-50	0.0574	-0.075
Population 51-65	0.981	0.798
Population 66-75	0.943	0.844
Population 76 and over	0.0129	-0.126
Constant	0.729*	0.852**

*\*p<0.1 \*\*p<0.05 \*\*\*p<0.01\*\*\*\*p<0.001*

We still see the relationship found by DiNardo et al. (1996) since the real value of the minimum wage does have a statistically significant effect on this low tail wage differential. That being said, this relationship is only significant at the 10 percent level, which brings to question how they found over two thirds of the change in this wage differential to be a result of the falling value of the minimum wage. As for the effects of the living wage on the lower end of the income distribution, this data does not provide significant evidence that there is a change in the effect of the minimum wage on inequality when the minimum wage is at or higher than the living wage. This is further enhanced by the evidence shown that increases in the minimum wage do not affect the countries that fit into the living wage group

differently than the countries that do not. Another important observation to make is that, unlike with the 90-10 percentile wage differential, there is not a difference in significance when comparing the one working adult model to the two working adult model. Both show the minimum wage to be statistically significant, but not the living wage nor the interaction term.

Finally since we did find results that were less significant than those presented in the paper by DiNardo et al. (1996), this brings up the question of whether the different data sets have an effect (since they looked at the differences between the 50 states while we compared different OECD countries) or is adding the living wage variable and the interaction term into the equation changing the results. In order to see this, we run the regression without either of the variables that deal with the living wage, the results for which are found in table 3.

Table 3.

Both wage differential models without the living wage related variables

	90-10 differential	50-10 differential
Minimum Wage	-0.0024	-0.0143***
Social Expenditures	-0.00000469	0.0000108
Urban Population	0.00558	-0.000322
GDP	0.000000107****	0.0000000968**
Unemployment Rate	0.0249***	0.00114
Poverty Rate	0.208****	0.0742****
Population Under 18	3.32*	1.86****
Population 18-40	0.000000337****	-0.0000000337
Population 41-50	-2.88	0.0866
Population 51-65	-1.98	1.116*
Population 66-75	4.19	1.65**
Population 76 and over	-4.87*	-0.0657
Constant	1.31	0.572**

\* $p < 0.1$  \*\* $p < 0.05$  \*\*\* $p < 0.01$  \*\*\*\* $p < 0.001$

These results are very interesting, since the effect of the minimum wage on income inequality without using the living wage related variables becomes extremely more significant for the lower tail of the income distribution, but for overall distribution, the effect of the minimum wage becomes less significant without considering the living wage. This ambiguously answers why some of the results seen here are different than those observed by DiNardo et al. since the lower tail differential would state that including the living wage would be creating bias in the estimates and making the minimum wage become less significant, while the full income distribution differential would show that accounting for the living wage would help eliminate bias and show that changes in the real value of the minimum wage do affect income inequality.

### **Conclusion**

The model presented by Anker (2006) for calculating the living wage does prove to show that there is a reduction in overall income inequality when a country sets its minimum wage equal to or higher than this value. That being said, this result only occurs when the living wage is calculated using the traditional two workers per family, as opposed to a one worker family which can be typically found in low-income households. However, the most likely explanation for this variation is that of the 231 observed minimum wages, 58.44 percent of them are above the living wage when calculated using two workers, while only 4.33 percent of them are above the living wage when calculated for one worker. This would show that there is probably not enough data to properly estimate

the effects of the one worker living wage on income inequality, since the calculation for one worker living wage produces a higher living wage, therefore countries that fall into the living wage category for one worker would have higher minimum wages. Based on all other findings, these extremely high minimum wages should produce even lower inequality, but the results were not significant. Finding more data that would include more observations for countries with minimum wages higher than the one worker living wage would provide for a more accurate estimation of the relationship and would be excellent for further research in to the subject.

As for the hypothesis that stated the minimum wage helps to reduce income inequality, we find that there is significant evidence to support this. Except for two of them, all of the regressions that were ran provide statistically significant estimations that show the negative relationship between the real value of the minimum wage and income inequality. The two that do not provide evidence supporting this hypothesis are the model that regressed the 90-10 differential on the one worker living wage (which was discussed earlier as to why these results could be biased due to a lack of observations) and the model that used the 90-10 differential but did not include living wage related variables. Although there is not a good theory as to why the second regression mentioned here provides different results, this one model should not disprove the findings that the minimum wage does reduce income inequality.

Our hypothesis that relates to the effect of the living wage is shown to be true for when looking at the full income distribution, but not when only looking at the lower tail distribution. Again, this is only looking at

the two worker living wage model. This shows that Anker's calculation for a living wage does lead to an effective estimate of the living wage since countries that have minimum wages at or above this level prove to have less income inequality, even though increases to the real value of the minimum wage past a certain level will eventually start to increase inequality in these countries due to disemployment effects of minimum wages that are too high. The fact that the estimate for the living wage's effect on the distribution of low tail incomes is not statistically significant does not disprove this hypothesis, but instead shows that minimum wage increase do not significantly change the income of minimum wage workers relative to other low wage workers. This could be a result of a spillover effect that were discussed earlier in the theory presented by Levin-Waldman (2001), which stated that "an increase in the minimum wage could exert an upward pressure on the wages of those earning above the new minimum wage."<sup>25</sup> Looking at the spillover effects of the minimum wage and seeing how they affect the lower tail of the income distribution would provide a good area for further research into this subject.

Overall, setting the minimum wage at or above the living wage does reduce income inequality. The policy implications of this would be that countries raising their minimum wages to be equal to the living wages calculated using Anker's model would help fight the rising income inequality. The idea is very simple, since the main objective of most minimum wage legislation, as stated earlier, is to reduce poverty.

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<sup>25</sup> Levin-Waldman, Oren M, 2001, *The Case of the Minimum Wage*, 32.



Therefore, setting the minimum wage at a level that is found using the poverty line, as is done in the model presented by Anker (2006), would help to reduce poverty and inequality.

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# Nominal GDP Targeting: A Policy Recommendation to Meet the Fed's Dual Mandate.

## A Fed Challenge Response Paper: Fall 2014

*By R. Shaw Bridges III*

### **Abstract:**

This paper was written in early December 2014 in response to the Federal Reserve Challenge Team's argument for a regime change in the Federal Reserve to nominal GDP targeting as the appropriate policy to return the U.S. economy to long-term sustainable economic growth. After the 2007 recession, the FOMC took extraordinary measures to minimize the collateral damage caused by bank balance sheets weighed down with mortgage-backed securities and other below-investment grade assets. The periodic "stress tests" and use of emergency lending facilities were historically unprecedented, however, the economy six years later was still growing slowly in part due to market uncertainty with FOMC forward guidance policy. This paper argues that the Fed is justified in using a policy that risks short-term rapid inflation in order to meet the "dual mandate" of full employment and price stability, and to prevent cyclical unemployment in the economy from deteriorating into structural unemployment.

In 2007, the United States suffered the worst economic downturn in recent memory. In response, risk-averse businesses and consumers have withdrawn from investment and spending in order to pay off outstanding debts. This process of deleveraging, while focused primarily in the housing sector, has not only slowed economic growth in the recovery, but has also led to persistently low rates of labor force participation as well as inflation (Wenli Li and Susheela Patwari 2012, 9, and Fed Challenge Manuscript (FCM) 2014). The initial measures the FOMC took to avert an economic depression during the recession, which included the opening of

emergency lending facilities and the implementation of periodic stress tests of bank balance sheets, were extraordinary, and until this disaster struck, historically unprecedented (Ben Bernanke 2012, 2). Now approaching six years into the official period of recovery with interest rates still at the zero lower bound, analysts are divided over their interpretations of relevant economic metrics, and whether or not they indicate the much-desired self-sustainable economic growth needed to return to stable price levels and labor market conditions. This disagreement over interpretations of economic metrics in different sectors has only exacerbated uncertainty in financial markets, evidence for which has become increasingly apparent with threats of bond-market sell-offs in anticipation of Fed Chair Janet Yellen's speeches after the monthly meetings of the FOMC (Gavin Davies 2014).

In his address to the NABE Policy Conference late in February, economist Lawrence Summers stated aptly that today, monetary policy experts “*wish* for the problem of minimizing fluctuations around a satisfactory trend” (Lawrence H. Summers 2014, 65). Yet, as economist Michael Woodford maintains, if policy-makers fail to act decisively and with the utmost transparency, there is a distinctive risk this “*wish*” for real growth and a return to full employment will not be granted anytime soon (Michael Woodford interview, 2014). In order to effectively communicate monetary policy in the near future, it is this author's contention that a regime change to nominal GDP targeting is needed [See Figure 1]. In this paper, I argue this suggested deviation from the current forward guidance policy is necessary to meet the dual mandate of full employment and price

stability. Not only does this policy allow the Federal Reserve to firmly commit to economic recovery in the short term, but it also eliminates instability associated with uncertainty over the current ambiguity regarding the decision to raise interest rates. While short-term rapid inflation is a risk, however, prolonged economic stagnation can lead to a deterioration of cyclical into structural unemployment, which produces long run hysteresis in the economy. This real risk is sufficient justification for the adoption of this bold policy measure.

### **U.S. Economy After the Recovery**

The Gettysburg College Federal Reserve Challenge Team's argument for nominal GDP targeting is reliant on several historical metrics that over the past several years have caused the Federal Reserve to adjust downward its estimates of future real growth. According to the Bureau of Economic Analysis, the most recent estimate in the third quarter of 2014 has revised real GDP upward to 3.9% from the previous advance estimate of 3.5%. This data point reflects a fall in the percentage change from last quarter, due to a downturn in private inventory investment and a deceleration in exports, investment spending, personal consumption expenditures, which was offset by an 10% increase in federal government consumption expenditure and gross investment (Lisa Mataloni, et. al. 2014). Despite the positive upward revision approaching the 4.6% growth in the second quarter, our Fed Challenge team was skeptical that the nearly 4.0% growth seen in these last two quarters is sustainable. The strong growth we have been experiencing over the past two quarters is a transitory

phenomenon due to a temporary decrease in oil and gas prices. Although consumers will have more to spend in the short-term, there is little reason to expect this level of growth to continue indefinitely (Patricia Cohen 2014). Yet, even if the BEA is now observing evidence of significant real growth, the persistent underperformance of the economy in the years since 2007 has led analysts at the Congressional Budget Office (CBO) to revise downward estimates of potential GDP [Figure 2] (FCM 2014). According to these estimates, Lawrence Summers argues, economists at the CBO believe we can return to a steady trend in growth, however, the leisurely speed of the recovery has caused them to reevaluate both the size of the capital stock and sustainable labor input (Lawrence H. Summers 2014, 66). These revisions have had the perhaps unintended affect of overstating the incremental upward movements in GDP analysts have observed in the last two quarters. The period of economic recovery we are experiencing has not involved a return of GDP to its potential.

This need for growth in excess of current trends is further exacerbated by estimates of labor force participation and the Bureau of Labor Statistics estimates of unemployment. Despite the recent positive indication of a drop in unemployment to 5.8%, a breakdown of this metric reveals a still volatile labor market [Figure 3] (BLS employment summary 2014). Both long-term unemployed and civilian labor force participation have been mostly constant since April, and still seven million are employed part-time out of necessity, possibly due to a skills mismatch [Figure 4] (ibid). Furthermore, while employment has shown marginal growth in health and food services industries, financial, mining and logging,

information, wholesale trade, and government employment numbers have largely remained unchanged month to month (ibid.). As our team indicates, the revision to 5.8% places us at the high end of the bracketed region of unemployment estimates for October between 5.2 and 5.8 as depicted in Figure 4. Contrary to the narrative of improvement and progress toward full employment, the Fed Challenge team argued that the consistently slow restoration of labor force participation indicates just the opposite. They cited November estimates of labor force participation at 62.8% of the population, which shows little improvement from 63% in September this year. Likewise, in their report for the Federal Reserve Bank of Cleveland, Stephanie Aaronson and colleagues indicated that the employment to population ratio (currently at 59.2%) is still only little over a half percentage point higher than the low in the recovery period (Stephanie Aaronson et al., 2014, 2). Labor force participation changes in response to factors such as declining market opportunities, wage growth, import competition, and retirement, under good economic conditions (ibid., 9, 12). Aaronson and colleagues indicates many participants dropping out of the labor force temporarily, such as young people enrolling in higher education programs, or discouraged workers, may have done so in response to slack in the labor market, and will likely return once conditions improve (ibid., 14). Using panel data of state level unemployment and LFP, the authors of this study found that between .25 and 1% of the decline in labor force participation was explained by cyclical effects. Yet, if a return of employment numbers an job growth is persistently slow, there is a risk that previously qualified workers will lose too much of their human capital. These authors reveal

cyclical pressures on employment and highering during the post-recession economic recovery, and more importantly, that there are still thousands of discouraged workers searching for employment opportunities (ibid., 22-4).

The Fed challenge team argued against economists who maintain that the currently low employment numbers in the U.S. are due primarily to pre-recession structural changes. Economists who argue that cyclical pressures often mask changes to the long-term composition of the unemployment rate have interpreted the Beveridge curve as evidence of structural unemployment. Peter Diamond and Aysegul Sahin's recent analysis of the "Beveridge curve" over past recessionary periods in the business cycle contradicts this narrative of structural unemployment in the labor market (Peter A. Diamond and Aysegul Sahin 2014). They reveal instead that the underlying relationship between the job vacancy and unemployment rates indicated by the curve reveals historically consistent outward movements following recessionary periods. These outward shifts suggest that firms are reluctant to resume a steady pace of new employee hires out of the labor force following a dip in production (ibid.). Whether due to the increased scrupulousness of firms selecting between potential employees from an unusually high population of qualified unemployed workers, or due to the continuation of the firm and household deleveraging process, firms are not hiring at high enough rates to put downward pressure on wages. This is evident from wage growth indicators such as average nominal hourly earnings, which is currently hovering at around 2.2 percent growth this past year [See Figure 5].



Federal Reserve Chair Janet Yellen indicates that while nominal wages have grown at a 2% rate for several years, in real terms wages have been flat (Janet Yellen Aug. 2014, 9). She argues this slow real wage growth will not exert “any meaningful upward pressure on inflation,” which means nominal wages will not rise for some time after employment starts to pick up (ibid). As our Fed Challenge team argued, this lack of inflationary pressure on wages will likely persist in foreseeable future, especially since oil prices, which recently dropped as low as \$65.9 per barrel at the end of November, has and will contribute to even lower long-term inflation [Figure 6]. Lower energy prices, while only temporarily putting downward pressure on inflation, have also led to a temporary surge in GDP growth that will only last as long as oil prices remain depressed (Jonathan Spicer and Rodrigo Campos 2014). In the aftermath of the recession, firms were unable to lower wages due to “downward nominal wage rigidity,” so layoffs were preferable. Now with economic conditions improving, firms have a larger pool of job applicants, including but not limited to the previously laid off workers (Janet Yellen 2014, 10). Therefore, these metrics collectively indicate a persistently sluggish labor market, which is certainly not creating the necessary demand for more workers to meet the Federal Reserve’s mandate of full employment (FCM 2014, 2).

In the years since the Great Recession, much analytical work has been done to grasp the economic implications of the process of household and firm deleveraging mentioned above. There has been a significant and steady downward trend in percentage of debt service payments to disposable

income. This downward trend shows that households are, as of early this year, continuing the process of deleveraging debts, such as paying down old household mortgages. According to Wenli Li and Susheela Patwari, the ratio of household credit to disposable income indicates that, as of 2012, U.S. citizens were only halfway through the process of deleveraging (2012, 15). The downward trend in the total credit liability as a ratio of disposable income reveals households are continuing to pay down this debt-overhang [Figure 7]. Moreover, household savings rates have remained high since the recession, hovering at around 3% higher than the low in 2007 [Figure 8]. In their book *House of Debt* (2014), Atif Mian and Amir Sufi argue that this process of household deleveraging has led to a lack of consumption growth, especially in low-income households that responded to the housing price shock by reducing their MPC (Atif Mian and Amir Sufi, 2014). Until this debt-overhang is paid down, household expenditures as a percentage of disposable income will continue to make an insufficient contribution to consumer spending and by extension GDP growth. Moreover, as economist Richard Koo has demonstrated, this process of deleveraging in the United States indicates we are recovering from a “balance-sheet recession,” which can lead to prolonged deficiency of aggregate demand (Richard Koo 2011, 1). He argues a policy that sets a low target for inflation is futile unless households are beginning to halt the deleveraging process. In the recovery from a balance sheet recession, aggregate demand is responsive to asset price changes, and not to relative changes in consumer prices (ibid). As the Fed Challenge team clarifies, however, the housing market as indicated under the Case-Shiller Home

Price Index, has recovered slightly this past year [Figure 9]. This is a positive indicator that a pick-up in consumer demand is possible, with a push from monetary policy-makers. In the next section, I argue the policy our team recommended supports this much-needed growth back to pre-recession trend of GDP.

Moreover, liquidity injections into the banking system have not increased the lending and borrowing practices of households and banks necessary to offset the fall in consumer spending. Lenders and borrowers are still repairing their damaged balance sheets and are hesitant to assume more debt-obligations due to perceptions of investment risk (ibid). Firms and households have been forced for years to deleverage their existing debts, despite interest rates at historic all-time lows. There has been some concern that banks are more likely to abuse the risk-taking channel and take on excess amounts of low-quality credit due to relaxed lending standards associated with future expectations of low interest rates (Teodora Paligorova et. al., 2012, 25). Yet the deleveraging process left banks that had damaged balance sheets following the recession with their hands tied behind their backs, hesitant to lend borrowers. Recently, however, the number of banks reporting tightening lending standards has dropped significantly, indicating that lenders are beginning to make loans to borrowers with potentially poor credit ratings. As the Fed Challenge team research into the financial sector indicates, there has been a renewal of levered loans despite the opposition of financial regulators, indicative of the below investment-grade securities packaged and sold before the financial crisis.

Investors will likely sell these leveraged loans with impunity to clients who in search of cheap, high returns, so long as the Federal Reserve continues to keep interest rates low [Figure 10] (Peter Eaves 2014). In a *Financial Times* article written this September, Tracy Alloway and Gina Chon indicate more than a third of loans given out by U.S. banks in 2014 came with leverage exceeding Federal Reserve guidelines, which are supposed to limit loans to bearing a value no more than 6x a company's annual earnings (Tracy Alloway and Gina Chon, 2014). Thus, the "frothy" growth we have experienced in the financial sector is likely more artificial and hence unsustainable outside zero-lower bound conditions. Koo argues that the "trauma" firms and households experience after paying down the debt-overhang creates an "exit problem" following balance sheet recessions. This phenomenon has been observable in Japan since the 1990s, where the private sector is borrowing averse, interest rates are at the zero-lower bound, and government debt as of 2012 was 237 percent of GDP (Richard Koo 2011, 34). The concurrent volatility of financial markets and household deleveraging in the United States renders higher interest rates an impractical Federal Reserve policy in the near future.

Still, expectations of positive economic improvements in the United States has led both to appreciation of the dollar, and depreciation of foreign currencies [Figure 11]. Recent developments in foreign markets suggests that global economic growth may bear down on domestic growth as well. The Bank of Japan has recently opted to continue another round of LSAPs indicating efforts to depreciate the Yen. Likewise, ECB banks of Sweden, Norway, and Switzerland will likely decide to adopt similar

unconventional policies such as LSAPs to stem the appreciation of the Euro (Nouriel Roubini 2014). New York Fed President William Dudley recently commented on Bloomberg that if the dollar appreciates against these foreign currencies, the result could mean lower net exports and a subsequent “dampening” of inflation (Alister Bull 2014). In developing a policy, the Federal Reserve must consider the possibility of external threats to self-sustainable growth in the coming years, and weigh the risks of high inflation compared with continued disinflation in the economy.

### **Defense of Nominal GDP Targeting**

This fall, the Gettysburg College Challenge Team offered what I have maintained was a convincing analysis of the state of U.S. macroeconomic conditions in the wake of the 2007-9 recession. The U.S. economy since the Great Recession has been growing at a sluggish pace resulting in higher labor market slack than indicated by the current 5.8% unemployment statistic. Moreover, recent data indicators, such as dropping energy prices and irresponsible financial investment have led to spurious signs of growth that is unsustainable outside zero-lower bound conditions. In the past two months, the Federal Reserve has ceased its program of Large Scale Asset Purchases, leaving forward guidance strategies as our primary tool to reduce long-term interest rates (FCM 2014, 3). Different types of forward guidance strategies have been tested over the course of the recovery, and policy-makers differ in their opinions of its effectiveness. From August, 2011 to October, 2012, the Federal Reserve tried calendar based forward guidance, promising to keep the federal funds rate near zero

until a specified date in the future (ibid.). In December 2012, the Federal Reserve altered its criteria to data-based forward guidance, by promising to keep rates at the zero-lower bound until the unemployment rate passed below the threshold set at 6.5% (ibid., 4). Extensive economic literature has been amassed analyzing the benefits and drawbacks of both calendar and data based policy recommendations. There are significant practical disadvantages of these previous policies that constrain the economy from generating the growth necessary to avoid the threat of secular stagnation. I maintain that in order to achieve the growth we require, the Federal Reserve must adopt a more integrative approach to forward guidance, which targets nominal GDP instead of inflation.

In the past few years, policy-makers at the Federal Reserve have concentrated on chasing the simultaneous goals of stronger growth, capacity utilization, and financial stability, yet as the macro-economic analysis above reveals, this tripartite objective has become more difficult under zero-lower bound conditions (Lawrence H. Summers 2014, 66). As economist Larry Summers indicates, the economy is today underperforming at the potential level forecast in 2007 for the year 2014/15, and the improvements described by the unemployment to population ratio are murky [Figures 1 & 3]. The U.S. economy has made almost no progress returning to potential output, but Summers argues that declining real interest rates should concern policy-makers more (ibid., 69). He argues economists might be observing a period he describes as a “reversal” of Say’s Law, in which deficient demand yields deficient supply, and that the continuous lowering of interest rates to supply the labor force with jobs could render

monetary policy ineffective, and suppress economic growth indefinitely (ibid., 71). The result of this secular stagnation could eventually lead to a vast number of unemployable workers and a contraction in productive capacity, resulting in hysteresis (Matt O'Brien 2014). Moreover, Summers indicates the historical record suggests financial instability goes hand-in-hand with periods of growth. In the recovery period of the business cycle especially, with interest rates at the zero lower bound, stability in the financial sector becomes harder to achieve in conjunction with strong growth. Instead of waiting for the economy to grow naturally, policy-makers should therefore welcome the inflation necessary to contribute to meaningful growth in output.

Summers suggests that the increased MPS of households and firms resulting from changes to income distribution, cash hoarding by large corporations, and other debt-financed investment demand reducing activity may have also lowered the natural equilibrium real rate of interest (Lawrence H. Summers 2014, 69). Likewise, Minneapolis Federal Reserve President Narayana Kocherlakota argued at the 22<sup>nd</sup> Annual Hyman P. Minsky Conference that in the past six years, the U.S. has experienced changes in demand for safe assets that may persist over the coming decade (2013, 2). Kocherlakota contends that, given the poor outlook for employment and prices, the FOMC should lower the real interest rate even further below the 2007 threshold in order to generate significant growth (ibid., 6). This growth produced under conditions of low real interest rates will likely not come without the cost of financial instability that can occur with “inflated asset prices, high asset return volatility and heightened

merger activity” (ibid., 11). The preponderance of conceivable outcomes these authors cite suggests the risks associated with generating significant growth are difficult to avoid under slow recovery conditions.

The recommendation for nominal GDP target in part derives its strength as a policy from the argument that under current economic conditions, there is a chance the U.S. could be heading towards secular stagnation. Summers and Kocherlakota’s analyses in conjunction with the data our Federal Challenge Panel cited in reference to labor market conditions and the output gap indicates the risk of prolonged economic stagnation could lead to a contraction of human capital resulting in hysteresis. In addition to providing a clear policy criterion both for the FOMC and financial markets, the nominal GDP target could solve the issue Summers and Kocherlakota emphasize regarding the real interest rate and inflation. As Harvard Professor Jeffrey Frankel indicates, a nominal GDP target guarantees either acceleration in real growth, or that real interest rates will decline in response to the policy, which will in turn put upward pressure on aggregate demand (Jeffrey Frankel 2012). If indeed the U.S. is heading toward similar stagnation to the Japanese economy for the past two decades, the window for the Federal Reserve to adopt growth-supportive policies is narrowing with each passing year.

Unlike price-level targets, which have been judged to be a similar objective criterion, a nominal GDP target would provide greater quantitative gains. According to Jérémie Cohen-Setton et. al. (2013), five years out of the 2007 recession, the price level was not much lower than it would have been growing at 2% per year, whereas nominal GDP fell nearly 10%, as



indicated in Figure 1. They maintain the rise in expected inflation would thus have been smaller under the price-level targeting regime. Critics such as Charles Goodhart argue that unlike inflation targeting, however, NGDP would function poorly as a kind of Taylor rule, since it would entail both an interest rate as well as an output measure, and thus revisions to NGDP over time make the risk of overshooting the target at any given interest rate more volatile. A proponent of this policy innovation, Scott Sumner argues that unlike inflation targets, an NGDP target would only require a single estimate of the output gap at the time the target was set, thus avoiding the constant revisionary estimates to the output gap associated with “flexible inflation targets” (ibid., bibliography). Although there are difficulties associated with finding a long-run sustainable trend that would support the economic environment for employment and growth, as Scott Sumner argues, it would not be unreasonable to look at what past forecasts of growth had been prior to the recession as the goal (Scott Sumner 2012, 10). Suppose that the estimate for the growth rate set to reach a nominal GDP target would overshoot the target if growth accelerated or decelerated in the near future? The Federal Reserve would only have to make minor adjustments to forward guidance policy and other similarly influential policies on future expectations, in order to avoid overshooting the target. In this way, it would be clear to outside observers what the Federal Reserve’s future plans for the economy are under all possible scenarios for growth. Thus, this single criterion communicates the Federal Reserve’s intentions more efficiently than if continuous revisions were made to policy and hence future expectations based on an output gap estimate.

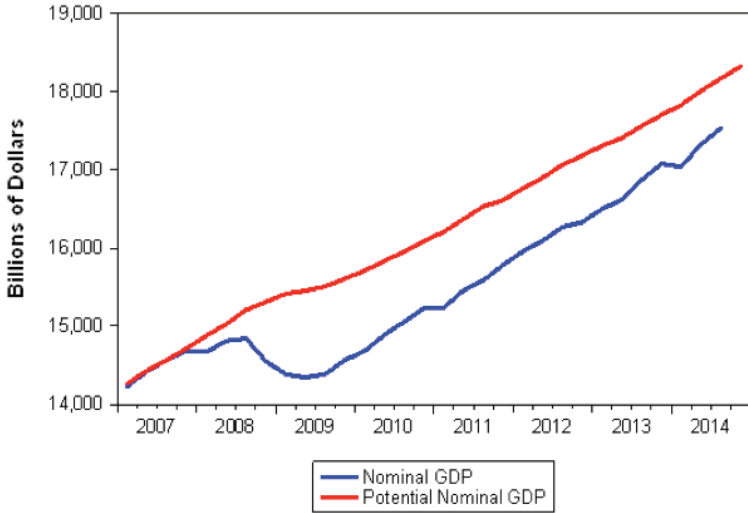
Furthermore, Charles A.E. Goodhart et. al. (2013) argues that a nominal GDP target policy regime would allow inflation to appear even more volatile than under price level targeting, because of uncertainty over long-run sustainable output. Yet as these recent critics of NGDP targets show, once the Federal Reserve sets the forecast for long-run sustainable growth at the pre-recession forecast, the Federal Reserve could also deliver a 2% inflation target at that long-run rate. In order to mitigate the risk of future adjustments to NGDP, Sumner argues, the Federal Reserve could set up futures markets and subsidize trading of NGDP futures contracts. This would have the effect of anchoring investor expectations and forecast the required monetary base to boost nominal growth, by providing the public with incentive to return to pre-recession growth trend (Scott Sumner 2011, 17-18). For some at the Federal Reserve, this policy still presents a risk they are unwilling to take due to the uncertainty of previous forecasts, possibly due to ex post facto reasons associated with growth estimates prior to the recession. Scholars have misconstrued the majority of these components of NGDP targets as drawbacks that impede its implementation, and not as strengths, or at least net advantages over and above current inflation target policy. As it stands, our Team's current recommendation inadequately addresses these concerns and should be changed if more members of the Federal Reserve are one day to be swayed to by our assessment.

## **Conclusion**

The recommendation our panel made to the Federal Reserve is necessary to provide the much-needed future growth our economy needs to avoid secular stagnation. The current growth trends in the U.S. economy are indicative of slow growth from the recession of 2007-9, which will lead to persistently low labor force participation. Likewise, financial stability can only be achieved in strong growth conditions, once the Federal Reserve is able to raise interest rates without disrupting the process of deleveraging and subsequent growth in investment and consumer expenditure [Figure 12]. The sooner the Federal Reserve can return to pre-recession long-run sustainable growth trends the better. By setting a nominal GDP target, the Federal Reserve would be making a commitment to return the economy back to full employment levels before unemployed citizens of the United States become unemployable, and our potential output capacity contracts. Raising rates now would be premature, and while other policy regimes have had historically limited success, the burden of proof falls on our recommendation. As such, any one of the advantages to our policy discussed above could be used to persuade a battle-tested and wary Federal Reserve.

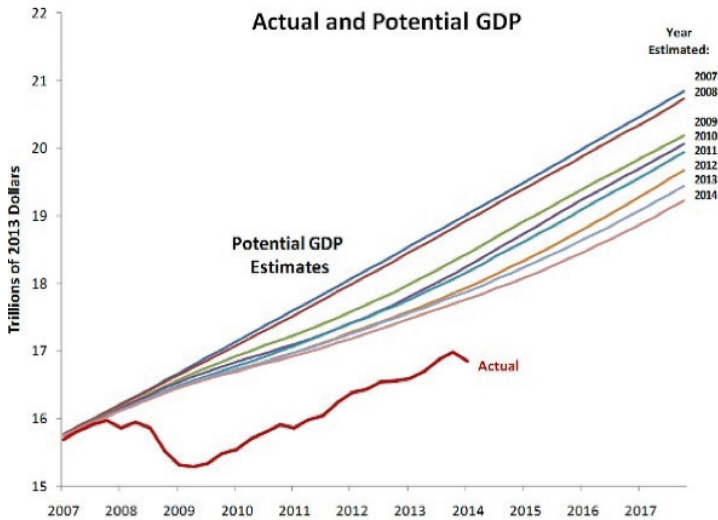
# Appendix

Figure 1: Nominal GDP & Potential Nominal GDP



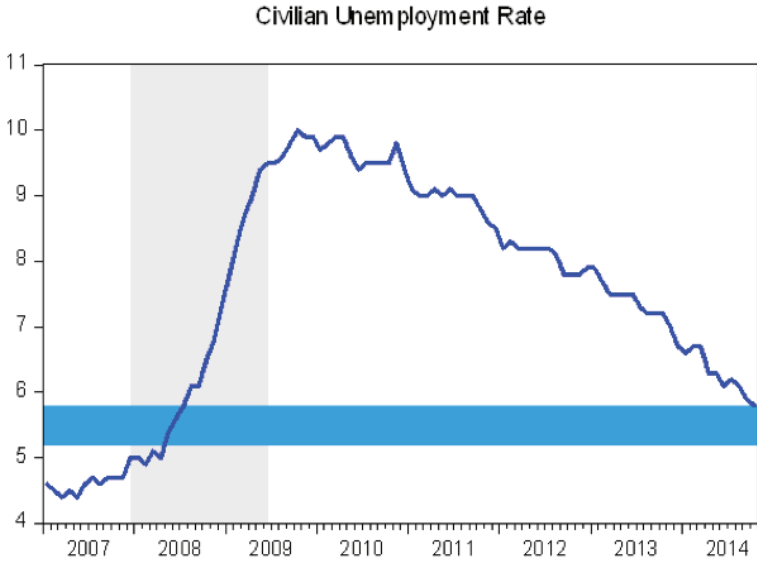
Source: Board of Governors of the Federal Reserve System

Figure 2: Revisions to GDP



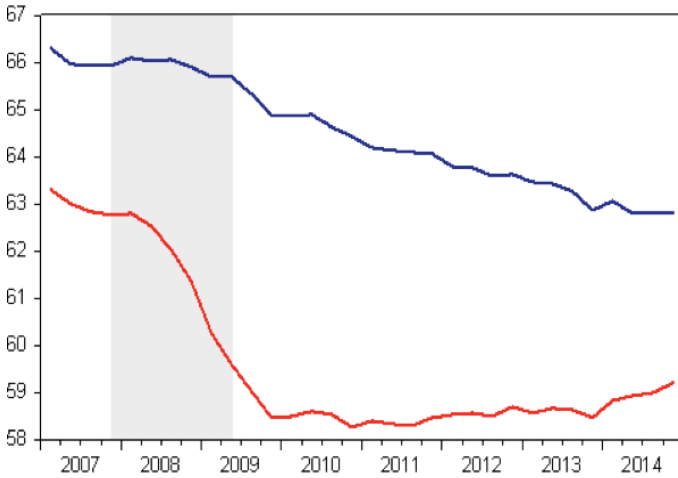
Source: VoxEU.org

Figure 3: Civilian Unemployment Rate



Source: U.S. Department of Labor: bureau of Labor Statistics

Figure 4: Unemployment Rate and Labor Force Participation Rate



Source: U.S. Department of Labor: Bureau of Labor Statistics

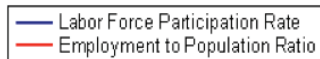
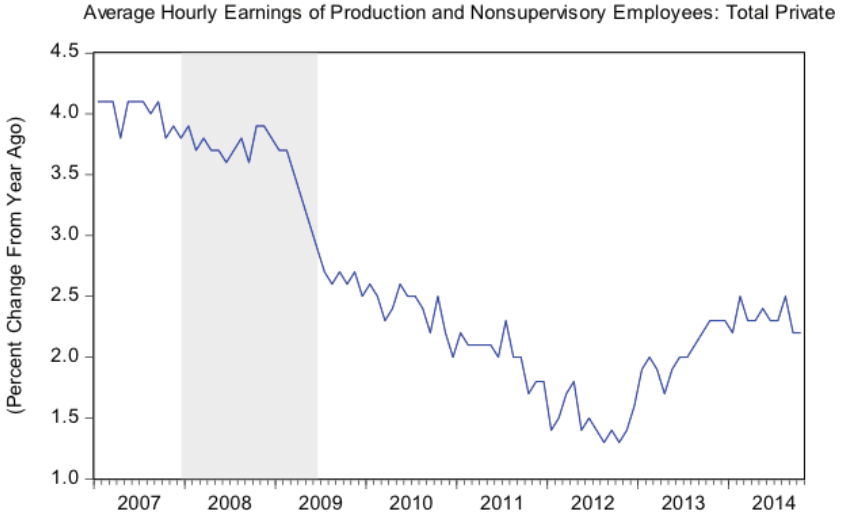
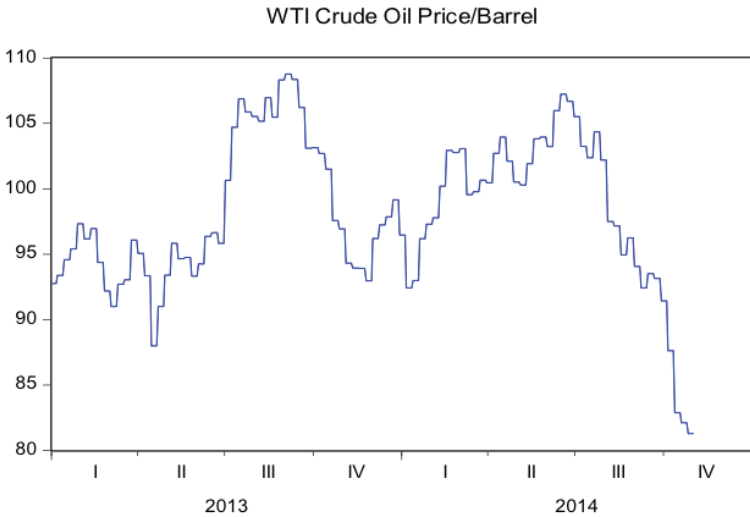


Figure 5: Wage Growth Average Hourly Earnings



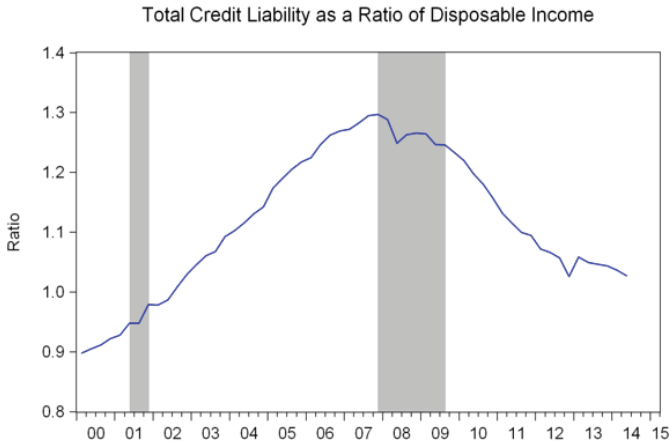
Source: U.S. Department of Labor: Bureau of Labor Statistics

Figure 6: Oil Prices over the past two years



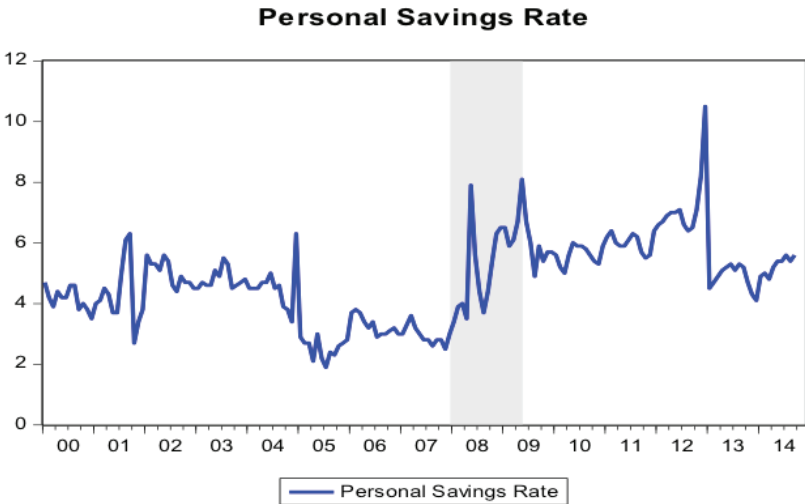
Source: Board of Governors of the Federal Reserve System

Figure 7: Measure of Household “Debt Overhang”



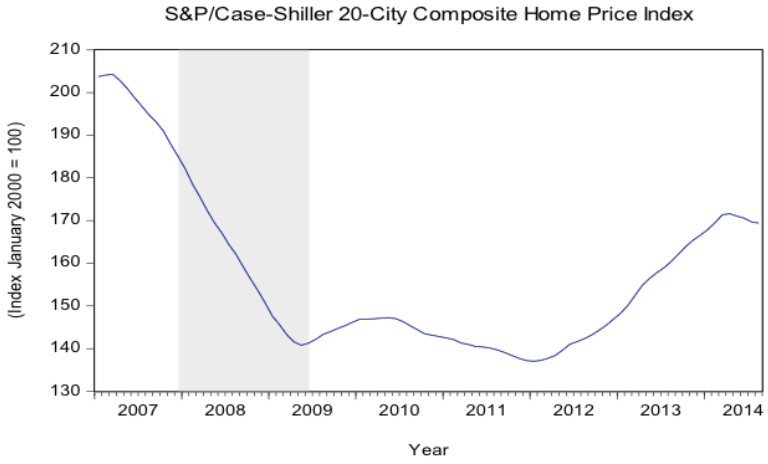
Source: Board of the Governors of the Federal Reserve, Bureau of Economic Analysis

Figure 8: Personal Savings Rate



Source: US Department of Commerce Bureau of Economic Analysis

Figure 9: Case-Shiller Home Price Index



Source: S&P Dow Jones Indices LLC

Figure 10: Bank Lending Standards

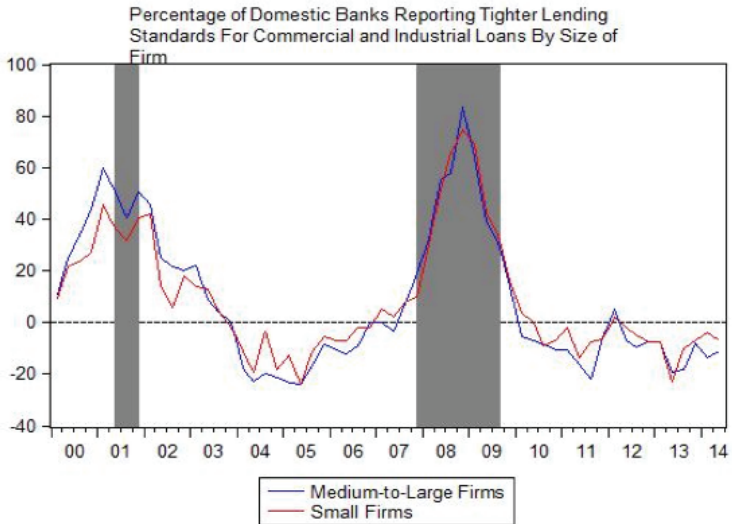
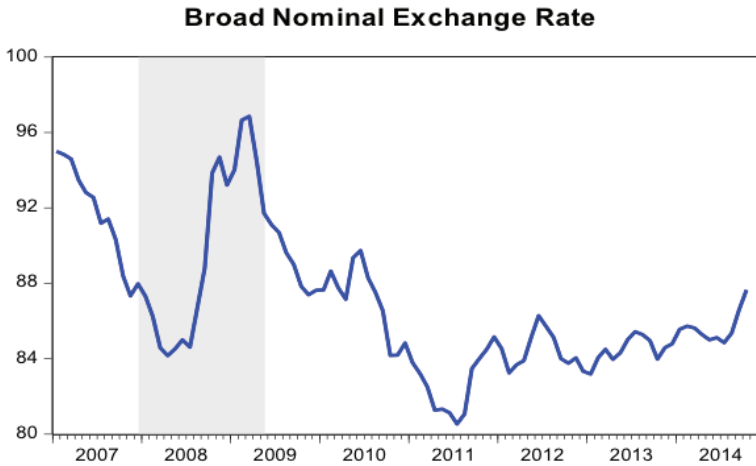


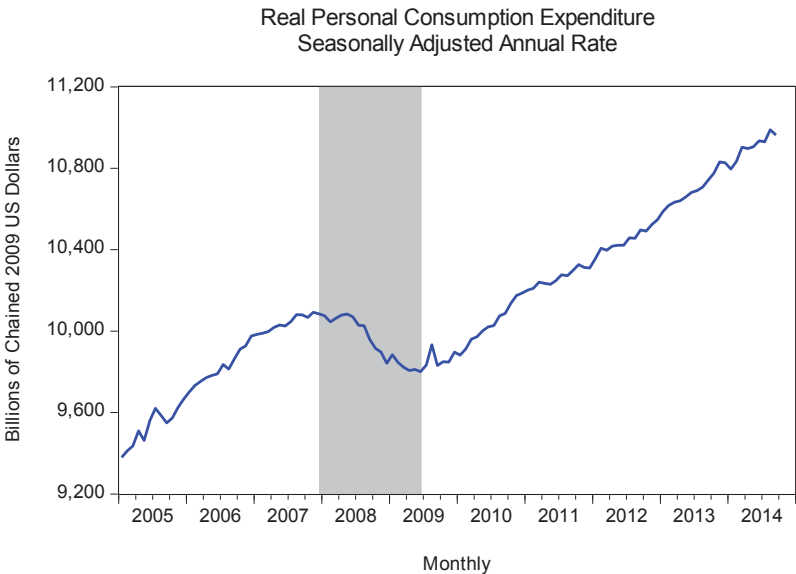


Figure 11: United States Nominal Exchange Rate



Source: Board of Governors of the Federal Reserve System

Figure 12: Consumer Expenditure



Source: U.S. Department of Commerce: Bureau of Economic Analysis

## **2014 Fed Challenge Script**

*by: Jieran Liu, Will Northrop, Matthew Nadler,  
Owen Rothe, and Ryan Williams*

Economics 267 & 367 Fall 2014

### ***Current State of The Economy***

Good afternoon everyone and thank you for having us here today. Though the recession began in 2007 and officially ended in 2009, recovery has been painfully slow. GDP growth has been insufficient to close the output gap, there continues to be slack in the labor market and inflation has stabilized below the Federal Reserve percent target. We are not meeting our dual mandate of full employment and stable prices even 6 years after the end of the recession. Despite some signs of strengthening in the economy during the past year, we do not believe that economy is on a self-sustaining path of recovery. Furthermore, the monetary policy actions taken by the Fed thus far to pull us out of the Great Recession have been insufficient. We propose a substantial strengthening of the our forward guidance; specifically, a commitment not to raise the federal funds rate until nominal GDP has returned to a path that we consider consistent with the dual mandate.

The Congressional Budget Office estimates the output gap to be around 3.6% in 2014 and projects a return to full employment by 2017. However, this forecast reflects the fact that the CBO has revised downward its estimate of potential GDP every year for the last 7 years. The economy is

approaching full employment not because of strong growth in actual GDP but because of repeated downward revisions in potential GDP. [VoxEU slide] Larry Summers estimates that half of the decline in potential output is due to a drop in the capital stock due to lower investment since 2008, a phenomenon that could be reversed with sufficient economic expansion.

The unemployment rate fell to 5.8 percent in October, at the top end of our current range of estimates for the natural rate of 5.2 percent to 5.8 percent. But, the low unemployment rate disguises a large amount of slack in labor markets. For instance, the labor-force participation rate has fallen from 65.9 percent to 62.8 percent since the beginning of the recession. While some is due to structural factors, research by Stephanie Aaronson and her co-workers finds that 0.25 – 1.0 percent of the decline is due to cyclical factors. The employment - population ratio is low, also suggesting cyclical factors contributing to unemployment. Probably the most convincing evidence of slack in the labor market is the failure of wages to rise significantly: average nominal hourly earnings increased only 2.2 percent in the year ending in October.

Inflation has been below the 2 percent target since 2012. According to the Bureau of Economic Analysis, the core PCE chain-type price index increased at a rate of only 1.4 percent for the twelve months ending in October. There are no signs of inflationary pressure in the economy. Oil prices have fallen in recent months due to global economic weakness and new energy supplies. The price of West Texas Intermediate crude oil has fallen to \$81 per barrel at the end of October from over \$100 in June.

In addition, the dollar has appreciated significantly against other major currencies, putting downward pressure on prices of imported goods. And again, wage growth has been subdued. The absence of inflationary pressure is apparent from the decrease in the spread between the yields of 5-year nominal Treasury Securities and 5-year TIPS bonds (or the ‘breakeven inflation rate’) which has fallen from 2 percent in June to 1.6 percent in November. This indicates that the market expectations are currently that inflation will fall short of the target for the next five years.

The current sustained weakness in the economy is likely to persist for a long time. The crash in the housing market weakened household balance sheets. Research by Atif Mian and Amir Sufi has shown convincingly that the debt overhang has contributed to weak consumption growth. Richard Koo calls this a ‘balance sheet recession’ and notes that recovery will be slow because of household deleveraging, which reduces consumption spending. Koo and other economists such as Larry Summers and Olivier Blanchard warn of the possibility of insufficient aggregate demand for as long as the next 10-15 years.

A self-sustaining recovery cannot occur until households have worked off the debt overhang. Data on household debt show that there is a long way to go. Total credit market debt of households is 105 percent of disposal income, still higher than any year before 2002. Consistent with Koo’s theory, household savings remains high, especially relative to pre-recession trends. The personal saving rate has been above 5 percent since the recession, compared to 2-4 percent from 2005-07. Recovery in the housing market is widely seen as essential for improvement in household

finances. But after signs of strength in 2013 the housing market has cooled off in 2014. According to Case-Shiller home price index, house prices fell 1.3 percent from April to August of this year. Real residential investment has fallen by one percent in the year ending in the third quarter of 2014.

Recent positive developments have caused speculation that we will start raising interest rates in mid-2015. This is premature. Though GDP growth was estimated to be 3.5% in 2014 Q3, the widening of the trade deficit for September suggests that this figure will likely be revised downward. The results of the midterm elections suggest that fiscal policy could become more of a drag on economic performance in the near future due to increased pressure to cut spending. The low employment growth domestically, coupled with slow projected growth for Europe and certain emerging economies, suggest that making monetary policy less accommodative would be premature and costly to a still-shaky American economy.

### ***Our Policy Recommendation: Clarify Forward Guidance***

With the phasing out of large-scale asset purchases last month, we are currently relying on forward guidance to reduce long-term interest rates. But the type of forward guidance that we have employed since 2009 has been less effective than it could be. From August 2011 to October 2012 we specified that we would keep the federal funds rate near zero until a particular date, a policy known as calendar-based forward guidance. In December 2012 we switched to a data-based forward guidance strategy

by promising not to raise the federal funds rate until the unemployment rate fell to 6.5%. But in March 2012, as the unemployment rate was dropping more quickly than anticipated, we changed our criteria to a mix of labor market conditions. Michael Woodford has argued that the our statements to this point have not had the desired effect because the we have not been clear enough about the criteria that we will use to judge whether to raise the federal funds rate. As a result the we have not been as successful in managing long-term interest rates as it could be.

We propose that the Federal Reserve clarify the criteria that will trigger the beginning of interest rate increases. Under our proposal, which is similar to recommendations made by Michael Woodford and others, the FOMC will pledge to maintain the federal funds rate target at its current range as long as nominal GDP remains below a deterministic path. This path would represent the path it would have followed if monetary policy had not been constrained policy by the zero lower bound since 2008. Specifically, as indicated by our proposed statement, we project a trend of 4% annual growth in nominal GDP from the fourth quarter of 2007. We commit to holding off on interest rate increases until we are close to the target. When we are close to the target we will begin to increase interest rates at a measured pace so that policy is normalized at the trend level of GDP.

Our proposal improves on the current forward guidance strategy in the following ways.

- The nominal GDP criterion clarifies the ultimate goals of the FOMC. It replaces the vague references in the current statement

to “a wide range of information, including measures of labor market conditions, indicators of inflation pressures and inflation expectations, and readings on financial developments.” We thereby send a clearer signal to the public about how much more growth must occur before we begin to raise interest rates.

- We estimate that under this proposal we will not begin raising interest rates for at least two years. This is a more expansionary signal than the current policy, under which expectations are for rate increases beginning next summer, which will lower long-term interest rates.
- The nominal GDP criterion promises a combination of real economic expansion and higher inflation. The prospect of economic expansion will increase consumer and business confidence and generate higher spending. The prospect of higher inflation will generate more spending by lowering real interest rates. Higher inflation also reduces the real value of household debt, which will assist in recovery of balance sheets. This is an improvement over the current policy, which risks signaling to the public that the Fed views the current state of the real economy and inflation under two percent as satisfactory outcomes.

We have prepared some forecasts of what our policy implies for the economy. The scenarios shown on the graph assume that the real output gap is currently 4 percent and the growth rate of potential GDP is 2 percent. Real GDP has grown at an annual rate of 2.3 percent in each of

the last two years. At this pace, it will take over 13 years for the economy to reach full employment.

- Nominal GDP is currently 8.7% below the nominal GDP trend line that we hope to achieve. We assume that trend nominal GDP grows at 4% per year.
- Scenario 1 assumes that the combination of lower long-term interest rates and increased expectations of growth and inflation causes nominal GDP to reach its target in two years. This requires nominal GDP to grow at an average rate of 8.4% per year. Inflation in excess of current levels is unlikely unless there is a strong pickup in real GDP growth, so it is reasonable to assume that nominal growth is roughly evenly divided between real growth and inflation. This would imply 4.2% real growth and 4.2% inflation per year, which would eliminate the output gap in the year that the nominal GDP target is achieved.
- Scenario 2, which we believe is more likely, assumes that the nominal GDP trend line is reached in three years. This requires nominal GDP to grow at an average rate of 6.9 percent per year. If growth is evenly divided between real growth and inflation, this implies 3.5 percent real growth and 3.5% inflation per year, and again the output gap is eliminated when the trend line is reached.
- Scenario 3 assumes a four year path to recovery. This requires nominal GDP to grow at an average pace of 6.2 percent per year. Real GDP grows at 3.1 percent and inflation is 3.1 percent, and the output gap is eliminated when the trend line is reached.



Our policy risks higher inflation if the output gap turns out to be smaller than we believe it is. For example, under Scenario 2, nominal GDP grows at a rate of 6.9 percent per year. If the output gap is two percent rather than four percent, we could conceivably see the output gap eliminated in two years and real growth falling to two percent in year three, which would imply a 4.9 percent rate of inflation in that year. Clearly inflation at that level is not acceptable in the long run, but a temporary burst of inflation is a small price to pay for full recovery from the recession. In the final analysis, even in the high inflation scenario the average inflation rate beginning in 2007 will be near the our target of 2 percent; the higher period of inflation we promise for the most part merely compensates for the below-target inflation of the last several years.

To conclude, we find that the economy is in worse shape than it appears to be judging from the unemployment rate and the CBO's estimate of the output gap. The Federal Reserve has fallen short of its mandate of full employment and price stability since the recession began in 2007. Our proposal offers a chance to restore full employment and price stability. It does so by clarifying the our forward guidance statement: specifically, by committing us in terms that are as explicit as possible to a period of growth and reflation. It is a bold step, but one that is absolutely necessary in light of current economic conditions. Thank you for listening, and we welcome your questions.

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# **Flooding in the Kashmir Valley: Macroeconomic Effects of a Natural Disaster in India**

*by Danielle Cupp*

## **Abstract**

This paper presents India's economic growth by comparing it to that of the United States. In addition, this paper analyzes current events in India under a macroeconomic lens as it provides the macroeconomic impacts of said events. More specifically, this paper focuses on the ways in which unexpected severe flooding have impacted Northern India in the short-, medium-, and long-run. Analyses conclude with policy recommendations based on the goals of India's central bank, the Reserve Bank of India (RBI).

## **I. Executive Summary**

After gaining independence in 1947, India has experienced accelerated growth and is now considered one of the largest and fastest growing economies in the world. After a fiscal crisis in the early 1900s, India's economy adopted open-market policies and opened to international trade, which is considered one of the economy's most substantial boosts. India, however, still faces a number of challenges that impede on its development. India encounters, for example, extreme poverty and unresolved territory disputes with Pakistan and China. In addition, India is experiencing a period of anemic growth, in which its growth rate has declined to 4.4% since 2012. The Indian rupee has been depreciating, adding to these economic difficulties (Ranjan Mishra). India's central bank, the Reserve Bank of India, was conceived after independence in 1947 controls the monetary policy on the Indian rupee and its main objectives consist of maintaining price stability and ensuring that there is an adequate flow of credit to productive sectors in the economy ("About Us").

## **II. Summary on Developments**

Throughout this semester, I have analyzed the macroeconomic consequences of unanticipated events in Indian history while analyzing the nation's growth. When comparing India's GDP to that of the United States, we see that they are converging, affirming the theory that countries with a lower GDP experience higher rates of growth. In addition, we also see that India's output per capita growth rate, TFP contribution rate, and per capita capital contribution are all higher than those of the United States. All of these indicate that India's economy is growing at a faster rate than that of the United States.

In addition, I analyzed the macroeconomic effects of current, unexpected events in India. I predicted, for example, the ways in which output and unemployment would be affected by a devastating flood. I estimated that the impacts would be in particularly severe given the storm's unprecedented harshness and the fact that the economy in that region is heavily dependent on the agricultural sector. Next, I analyzed the macroeconomic impact on the power industry, specifically coal companies as they faced fines and incurred setbacks as the government revoked 214 coal leases. Lastly, I addressed the ways in which Prime Minister Narendra Modi's war on terror would affect the economy, specifically his crackdown on off-shore accounts. I predicted that Indians would transfer more of their money back into Indian accounts, increasing the money supply and increase total output in the country.

Figure 1

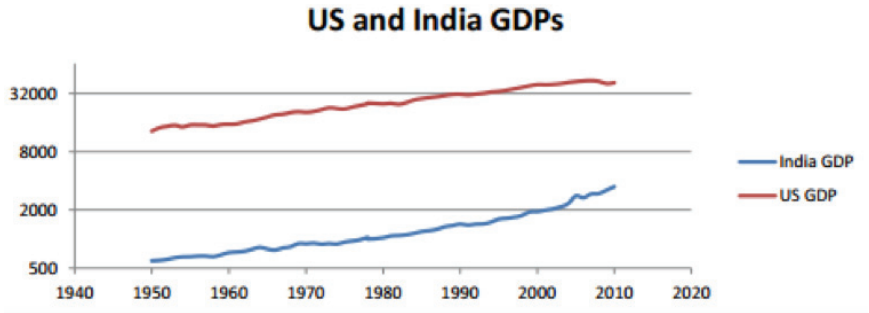
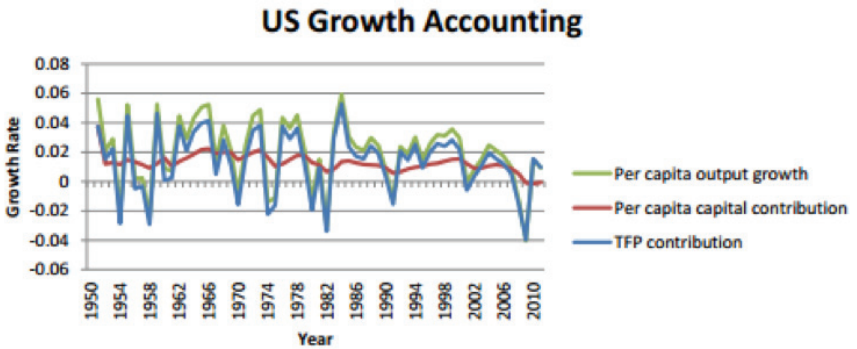


Figure 2



Figure 3



### **III. Shock Under Analysis: Flooding in the Kashmir Valley**

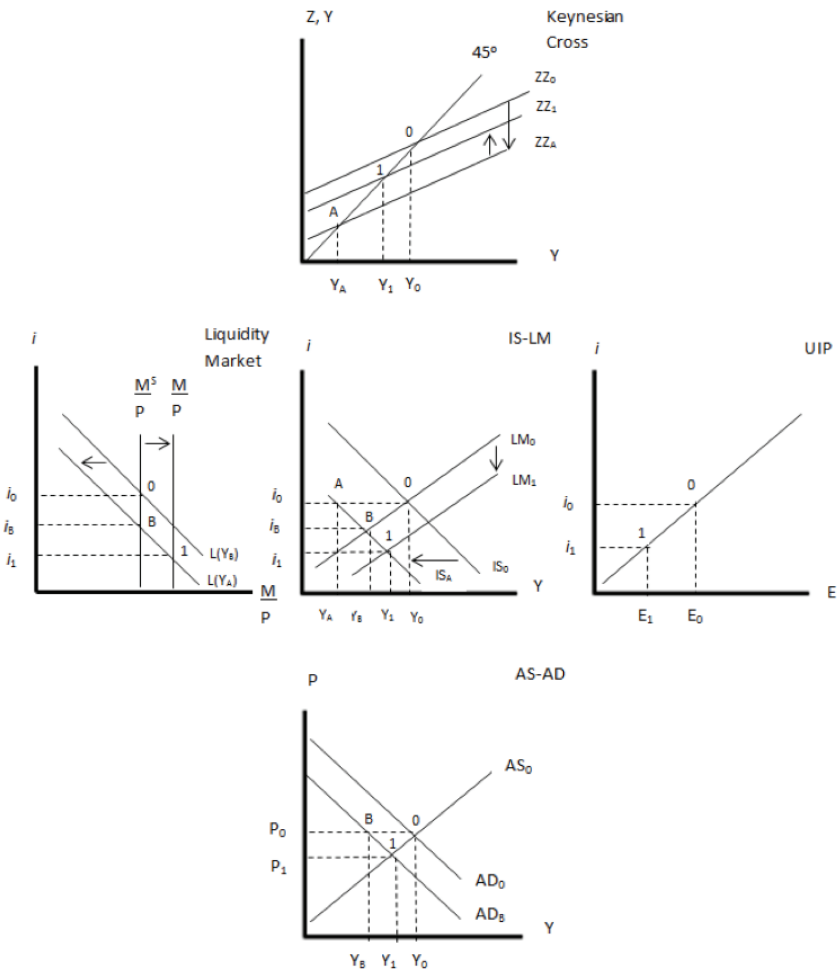
Flooding in the Kashmir Valley in September of 2014 hit record highs in this area of northern India. While monsoons bring devastation to this region every year, this disaster qualifies as a shock because it was the worst flood the valley has experienced in 100 years, leaving 600,000 people stranded and numerous roads, schools, bridges, crops, and hospitals destroyed. (“Kashmir Flood Disaster – How the Next One Could Be Avoided”). The Kashmir Valley lies in the Indian state of Jammu and Kashmir; the economy in this region is in particularly dependent on agriculture and related activities (“CHAPTER III: Socio-Economic and Administrative Development”). Since this flood occurred in September, the region has experienced more flooding, hindering the government’s ability to rebuild and return to the previous rate of productivity.

### **IV. Short-Run Analysis**

To examine the short-run impact on the harshness of the weather conditions, we will use the model provided below. The storm will decrease productivity, employment, and consumption, which can be modeled as a downward shift in the  $ZZ$  curve. When the  $ZZ$  curve shifts down, output decreases (to  $Y_A$ ) and the  $IS$  curve shifts leftward (to  $IS_A$ ). Due to the decrease in output, the demand for liquidity decreases, modeled by a leftward shift in the  $L(Y)$  curve (to  $L(Y_A)$ ). Now, the liquidity and goods markets clear at a lower interest rate and output level ( $i_B$  and  $Y_B$ ). When the shock is incorporated into the  $AS-AD$  model, the  $AD$  curve shifts left. As

a result, the price level decreases, which increases the real money supply. Now, the goods and liquidity markets clear at an even lower interest rate, but a relatively higher output level ( $i_1$  and  $Y_1$ ). Thus, the ZZ curve shifts up (to  $ZZ_1$ ), which demonstrates how the AS-AD model and the liquidity market reduce the multiplier effect. In addition, the exchange rate has decreased as the rupee has depreciated under the UIP condition.

**Figure 4**

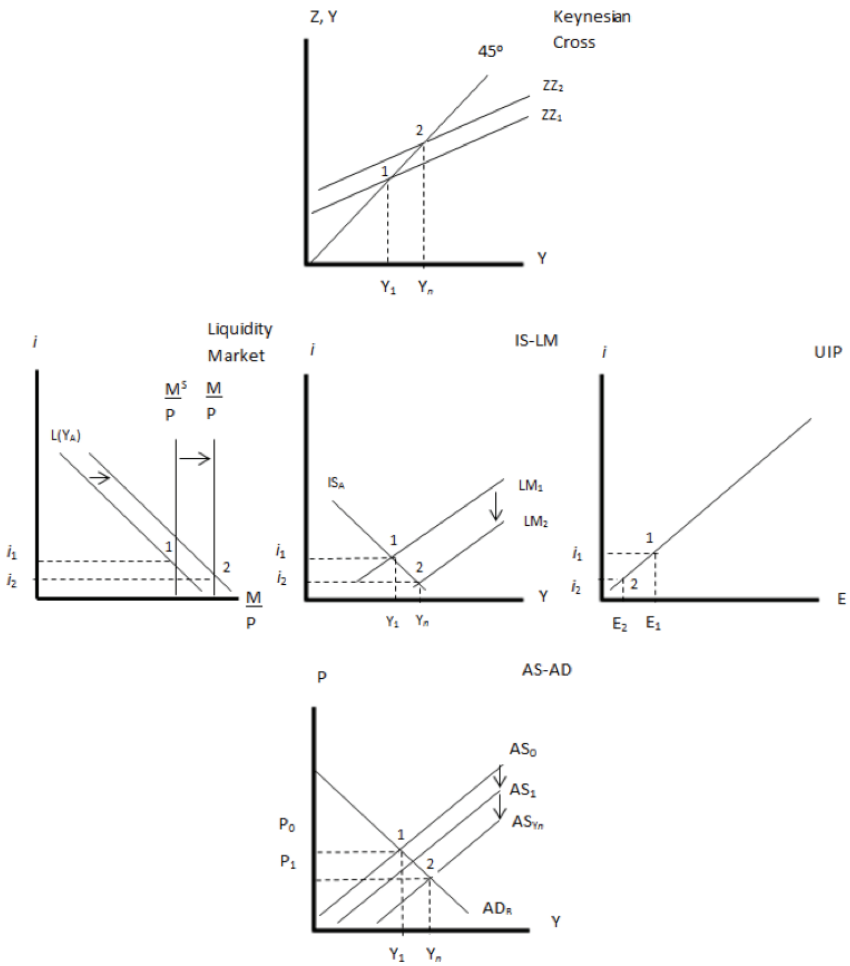




## V. Medium-Run Analysis

The same model can be used to display the medium-run implications of the shock. For simplicity, the graphs below only show the short-run equilibrium (1) with the output, interest rate, exchange rate, and price level from the initial equilibrium shown on the axes as a reference. In addition, India's natural rate of output has been added as the economy returns to the natural rate of output in the medium-run. India is characterized by a large output gap and chronic unemployment. The Reserve Bank of India has estimated that the Indian economy has a potential growth rate in the range of 8.2 to 10.2 percent, but in recent years the growth rate in India has fallen short of the lower limit ("Estimation of Potential Output in India"). In 2013, for example, India's economy only grew by 5% ("GDP Growth (annual %)"). As a result of the output gap and chronic unemployment, the natural rate of output will be higher than the initial level of output. In the medium run, output eventually returns to the natural level of output. This adjustment occurs through successive changes in the price level and is modeled by shifts in the AS curve. Since the natural level of output is higher than the actual rate of unemployment, the AS curve will shift down. This lowers the price level (to  $P_2$ ), which increases the real money stock. The rightward shift in the real money results in a decrease in the interest rate and a downward shift in the LM curve. Consequently, the decrease in the interest rate increases investment (from  $i_1$  to  $i_2$ ), which shifts the ZZ curve upward (to  $ZZ_2$ ). The exchange rate has decreased again and the rupee has continued to depreciate under the UIP condition.

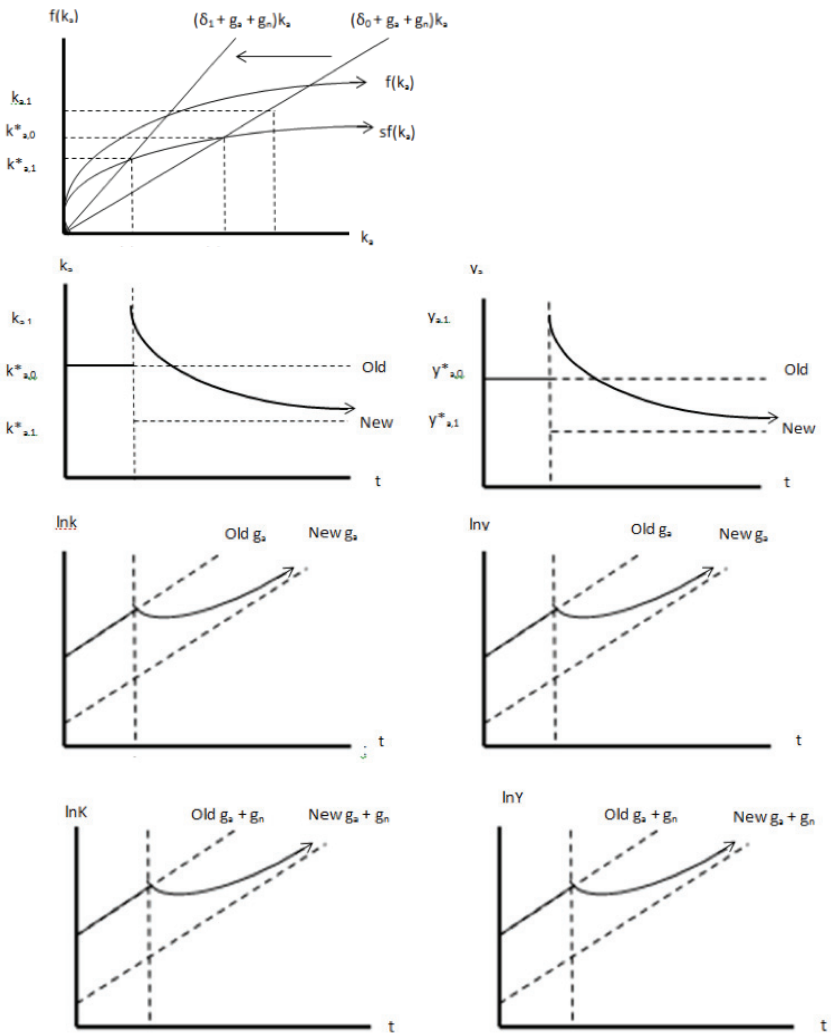
Figure 5



## VI. Long-Run Analysis

The long-run effect of this mass flooding in Kashmir can be modeled in the Solow Growth Diagram. The increase in the severity of this natural disaster (in addition to other flooding that the region already experiences) has caused the physical capital to depreciate more rapidly. This is modeled by a leftward swing in the break-even line. In addition, since the flooding was so severe that it destroyed crops, output decreased. This can be represented as a decrease in productivity ( $A$ ). This would increase the capital per effective units of labor, a rightward jump in  $k_a$ . Initially, the capital per effective units of labor jumps right (to  $k_{a,1}^*$ ) such that it is above the steady-state value ( $k_{a,0}^*$ ). Therefore, the amount of capital per effective units of labor that the economy is accumulating is less than the amount of capital per effective units of labor that the economy is losing due to depreciation, technological progress, and population growth. Capital per effective units of labor decreases (at a decreasing rate due to decreasing returns to scale) until it reaches the new steady state ( $k_{a,2}^*$ ). Now the steady state value is lower than it was initially due to the increase in the depreciation rate. The impulse response functions show the new balanced growth paths. The decrease in productivity means that output per effective units of labor and capital per effective units of labor jump up and then decrease at a decreasing rate until they reach the new, lowered balanced growth path. Output per capita and output both decrease at a decreasing rate until they reach their new, lowered balanced growth paths. These new balanced growth paths are lowered because productivity is permanently lowered by this shock.

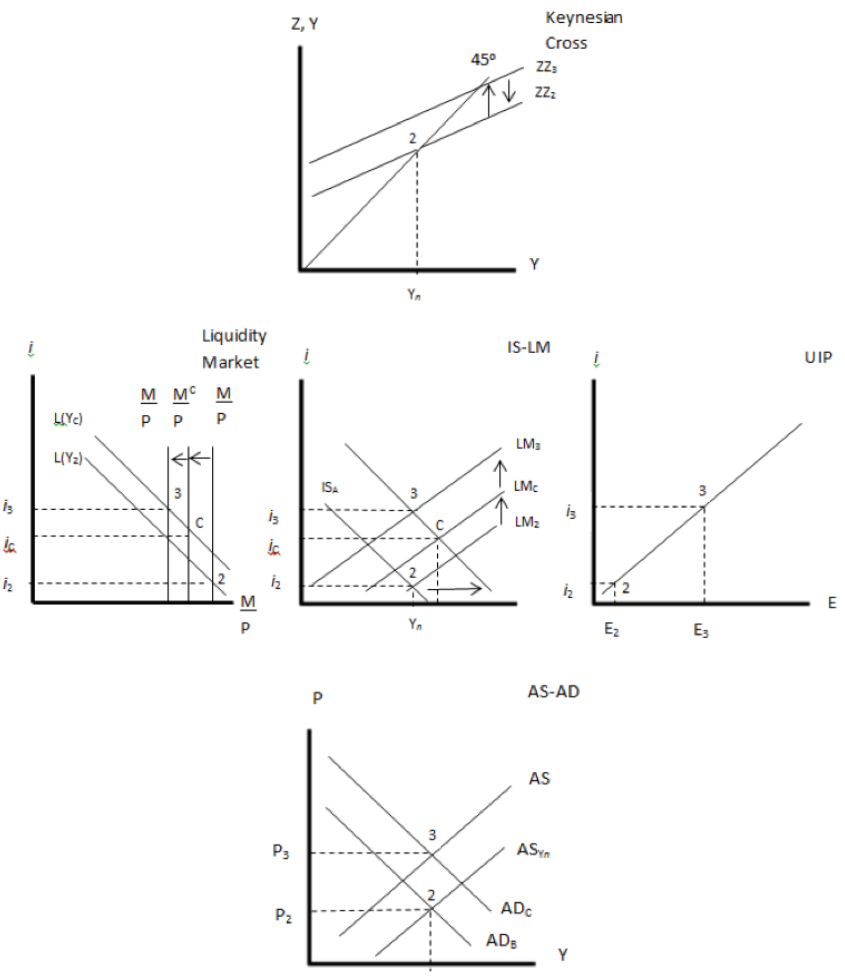
Figure 6



## VII. Fiscal and Monetary Policy Recommendations

One of the objectives of the Reserve Bank of India is to achieve price stability, but one of the long-run consequences of this shock is a decrease in the price level. I suggest both a contractionary monetary policy and an expansionary fiscal policy. Under both, the price level will increase, output will remain at the natural level output, and there will be an appreciation in Indian currency. As a result of the fiscal expansion and the contractionary monetary policy, the ZZ curve shifts up (to  $ZZ_A$ ), the real money demand decreases (to  $MC/P$ ) and liquidity demand increases (to  $L(Y_A)$ ). Consequently, the IS curve shifts right and the LM curve shifts up, such that  $i_c$  and  $Y_c$  clear both the goods and liquidity markets (at point c). The AD curve will shift right, but then the AS curve will also shift such that the economy returns to the natural rate of output. It is important to note that the net effect is an increase in the price level. As a result, the real money supply shifts left again, increasing the interest rate, which also shifts the LM curve upwards (to  $LM_3$ ). The liquidity and goods markets now clear at  $i_3$  and  $Y_n$ . The ZZ curve shifts down such that the output level is also at  $Y_n$ . While there was a fiscal expansion, the increase in the ZZ line was offset by the decrease in investment as the interest rate increased from  $i_2$  to  $i_3$ .

Figure 7



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