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A STUDY OF MACROECONOMIC VARIABLES THAT EFFECTED EMPLOYMENT IN THE UNITED STATES FROM 1948 TO 2021

Abstract
The paper provides an analysis of important U.S. macroeconomic variables that effect aggregate employment. The paper seeks to answer the question "What are the determinants of changes in aggregate employment in the United States of America (U.S.)?" This is an important research topic because significant increases in unemployment can have a profound effect on an entire society, not just on its unemployed workers. When employment declines, public health declines, crime increases, suicides increase, and public revenues decrease.

This paper uses quarterly data from 1948-2021 to estimate the effect of important macroeconomic variables on aggregate employment. The macroeconomic variables include personal consumption expenditures, U.S. federal government expenditures, nominal GNP, international trade (imports plus exports), M3 money stock, the minimum wage level, non-residential fixed investment, non-manufacturing employment, and U.S. federal tax receipts.

Keywords: Expected Demand, Employment, Consumption, Money Supply, Trade.

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1. Introduction

The paper analyzes available data series on variables such as: consumption, government spending, GNP, and international trade. The objective of the paper is to decide which data series are the best proxy for each variable. For example, the paper concludes that the personal consumption expenditures data series is the best proxy for the consumption variable.

The study of employment is an old issue in economics. Different schools of economics (e.g., Keynesian and Neoclassical) are based on economists' analysis of the causes of employment and unemployment. The classical theory of employment was developed by Smith (1776), Ricardo (1817), Say (1834), Mill (1848); and Pigou (1933). Their theories postulate that if market forces are allowed to operate in an economic system, they will eliminate overproduction and make the economy produce output at the level of full employment. Say is famous for the development of Say's Law, which states that the production of a product creates demand for a different product.

More modern theories of employment include the neoclassical theory of employment (Vercherand, 2014), and Keynesian theory as described in "The General Theory of Employment, Interest, and Money." (Keynes, 1936)

Neoclassical economists argue that employment policy should attempt to achieve greater labor market flexibility and wage flexibility so that perfect competition can be achieved. According to neoclassical economists, perfect competition will lead to the solution to the problem of unemployment. (See Bentolia and Saint-Paul, 1992; and Emerson, 1988)

The central belief of Keynesian economics is that government intervention should be used to stabilize the economy during booms and busts in economic activity. Jahan *et. al.* (2014) has explained that Keynesian theory is based on three principles. These three principles are: (1) aggregate demand is influenced by public and private economic decisions; (2) prices and wages respond slowly to changes in aggregate demand; and (3) changes in aggregate demand have their greatest short-run effect on real output and employment, not on prices.

2. Theory of Employment

My research hypothesis is that firms increase and decrease employment in response to changes in expected demand. This paper uses two proxies for expected demand: personal consumption expenditures (PCE) and nonresidential fixed investment (NFI). Businesses experience consumption daily and incorporate either the level of consumption (PCE) or the change in consumption from a previous period into their mathematical models. Typically, these model results indicate the level of demand in some future period and how

much they should invest as measured by nonresidential fixed investment. In turn, increases in NFI will result in the hiring of additional workers.

For example, a business might purchase additional equipment, expand existing offices, or open new offices. If a firm had a risk factor of 1.00, businesses would simply adopt the model results and increase or decrease NFI. However, firms are risk averse (Shackle, 1939). Because of their risk aversion, a firm will effectively multiply their risk factor by the level of expected demand indicated by their model. This process may occur either qualitatively or quantitatively.

A simple theoretical model of the relationship between expected demand and employment is provided in Equation 1. The simple form of the relationship between expected demand and the level of aggregate employment in a future period can be expressed algebraically as:

$$E_{t+n} = E_t + k(bD_t) \qquad \text{Eq. 1}$$

where:

E_t – is aggregate employment at time *t.*

E_{t+n} – is aggregate employment at time $t + n$, where n is the number of quarters between the analysis (time t) and the hiring or laying off workers. For an individual firm, the value of n is a function of the type of industry, marginal productivity of new workers, amount of training time required, competitive considerations, and other factors.

k – is a risk factor whose value ranges from 0 to 1.

D_t – is the level of expected demand for a company's goods and services at time *t*. Expected demand is composed of two variables: personal consumption expenditures and nonresidential fixed investment.

b – is the estimated coefficient of expected demand.

A variant of the method suggested by Liow *et. al*. (2006) was used to estimate the risk factor. They took the GARCH term in a GARCH (1,1) model as an estimate of the risk factor in a paper on the property stock market. My paper estimated a risk factor (k) of 0.72 using an FIGARCH (1,1) model. Regression results are given in Table A-1 of Appendix A.

The model given in Equation 1 provides a good approximation of the mean of the two series, which are the first difference of aggregate employment (EMP) and the estimated value of aggregate employment (ESTE). ESTE has a mean of 352.6206 compared to a mean of 354.4305 for EMP (a difference of approximately 0.5%).

3. Literature Review

The purpose of this literature review is to identify variables that some economists believe influence aggregate employment. The typical literature on employment focuses on a small number of variables that the researcher believes are statistically or theoretically significant. For example, Okun focuses on GNP, Keynes on effective demand, and neoclassical economists on perfect competition.

The literature review helped me to identify the following variables that some economists believe influence aggregate employment. The variables (or groups of variables) suggested by the economic literature are:

1. Personal Consumption Expenditures.
2. Government Spending.
3. Gross National Product (GNP).
4. International Trade (Imports plus Exports).
5. Investment.
6. Minimum Wage Level.
7. Money Supply.
8. Non-Manufacturing Employment.
9. Labor Productivity.
10. Taxation.
11. Education Level (only available annually).
12. Unionization (only available annually).
13. Inflation.

The literature review explored the three theoretical doctrines listed below. These doctrines were chosen because, taken together, they help explain much of the effect of the suggested variables on aggregate employment during the period of the study. The three doctrines are rational expectations, growth models, and labor economics.

3.1. Rational Expectations

Thomas Sargent has explained that “The theory of rational expectations was first proposed by John F. Muth of Indiana University in the early 1960s. He used the term to describe the many economic situations in which the outcome depends partly on what people expect to happen.” (Sargent, 1986)

Muth’s original work (Muth, 1961) was popularized by Robert Lucas in the 1970s. Lucas incorporated the idea of rational expectations into a dynamic general equilibrium model. (Lucas, 1972) Lucas has argued that expected inflation influences price-setting behavior, and therefore expected inflation becomes actual inflation. Employment is affected by a similar process: expected demand affects the behavior of employers regarding increases or decreases in employment.

If employers expect that demand for their products and services will increase in a future period, they will increase employment to ensure that they meet demand and are able to retain their existing customers. Conversely, if employers expect that demand for their products and services will decline in a future period; they may dismiss workers in order to maximize profits or to reduce expected losses.

3.2. Growth Models

Although the paper addresses the relationship between expected demand and employment, it is also useful to review the predictions of economic growth models. Okun's Law is a linear model which states that a 2% increase in output (GNP) corresponds to a 1% decline in the rate of cyclical unemployment; a 0.5% increase in labor force participation; a 0.5% increase in hours worked per employee; and a 1% increase in output per hours worked. (Okun, 1962)

In the U.S., nominal GNP and total non-farm employment are highly correlated (0.80) for the period 1948 Q1 to 2021 Q4. This paper found that the relationship between GNP and non-farm employment was similar to the relationships predicted by Okun's Law. As preliminary evidence, the paper estimated that the coefficient of a 1% change in GNP with respect to the percent change in employment was 0.50, which means that a 1% increase in nominal GNP should result in a 0.50% increase in total non-farm employment. Regression statistics are given in the Appendix to this document. (See Table A-2)

Christopoulos *et al.* (2019) found that Okun's threshold variable was endogenous and suggested a non-linear model. Guisinger *et al*. (2018) found that "indicators of more flexible labor markets (higher levels of education achievement in the population, lower rate of unionization, and a higher share of non-manufacturing employment) are important determinants of the differences in Okun's coefficient across states."

Nebot *et al.* (2019, p. 203) found that "differences between Okun coefficients below and above the threshold are consistent with the firm's 'risk aversion hypothesis,' according to which unemployment responds more strongly [to changes in GNP] during recessions than during expansions".

3.3. Labor Economics

Labor markets function via the interaction of workers and employers. Labor economics looks at the suppliers of labor services (workers) and the demanders of labor services (employers), and attempts to understand the resulting patterns of employment, wages, and income. These patterns exist because each individual in the market is presumed to make rational choices based on the information that they know regarding wages, the desire to provide labor, and the desire for leisure.

Using a New Keynesian model, Gali (2013) found that wage flexibility (*e.g.,* no minimum wage) does not always improve social welfare. Gali criticized the classical theory of employment for implicitly assuming that firms view themselves as facing no demand constraints.

Labor economists have suggested four subject areas that may explain changes in aggregate employment. These subject areas are discussed below.

3.3.1. The Minimum Wage Level

The effect of increasing the minimum wage on employment is a controversial subject. Alan Manning has pointed out that "A central concern in the [employment] estimates is whether one has controlled appropriately for economic conditions affecting employment other than the minimum wage. Failure to do so effectively will lead to bias if the minimum wage is correlated with the omitted economic conditions." (Manning, 2021, p. 12)

Meer and West (2016) found a negative employment effect using long lags in aggregate employment data. Neumark *et. al.* (2014) used a synthetic control effect and found a negative employment effect. These authors used a typical synthetic control effect by comparing data between different counties in the same U.S. state.

Bailey *et. al*. (2022) studied the large rise in the minimum wage due to the 1966 amendment to the Fair Labor Standards Act. They found that the amendment increased wages and reduced aggregate employment. Giuliano L. (2013) and Hirsch B. et. al. (2015) used payroll data and found that increases in the minimum wage resulted in wage effects but did not result in significant decreases in employment.

Finally, Manning recently reviewed some of the literature on the economic effect of changes to the minimum wage. He concluded that: "A balanced view of the evidence makes it clear that existing evidence of a negative employment effect is not robust to reasonable variation in specification, even when the wage effect is robust. One has to acknowledge that the impact of the minimum wage on employment is theoretically ambiguous." (Manning, 2021)

3.3.2. Distortionary Taxation

Distortionary taxes are taxes that affect the prices of items in a market. "Harberger triangles" refers to the deadweight loss occurring in the trade of a good or service due to the market power of buyers, of sellers, or because of government intervention. The size of a deadweight loss is proportional to the size of the Harberger triangles. Greenwood and Huffman used 1948-1985 U.S. annual data and found that the Harberger triangles were associated with distortionary taxation. Major weaknesses of their analysis are (1) it did not account for the effect of the costs and benefits of government spending programs; (2) it measured government spending, not taxation;

and (3) it incorrectly assumed that all government spending is funded by federal income taxes.

Baxter and King found that "output falls in response to higher government purchases when these are financed by general income taxes." (Baxter and King, 1993, p. 333) McGrattan (1994) studied the effects of distortionary tax policies using a dynamic recursive stochastic equilibrium model. She estimated that the welfare costs of taxation were eighty-eight cents per dollar for capital taxes, and thirteen cents per dollar for labor taxes.

3.3.3. Consumption

Mortensen and Pissarides (1994) found that an aggregate shock induces negative correlations between job creation and job destruction, whereas a dispersion shock induces positive correlations. The job-destruction process is shown to have more volatile dynamics than the job-creation process. Their work implies that firms are risk averse.

Mian and Sufi (2012) studied the decline in U.S. employment from 2007-2009. They found that the decline in aggregate demand (consumption) was driven by shocks to household balance sheets. They estimated that 65% of the employment losses were caused by the decline in aggregate demand during this period.

Evi Pappa (2009) studied the effect of fiscal shocks on employment and on the real wage using U.S. federal government and state government data. Pappa used Real Business Cycle (RBC) and New Keynesian models to evaluate the data. She found that aggregate increases in government employment raise both the real wage and total employment.

3.3.4. International Trade and Employment

Nickell S. (1984) studied manufacturing employment in the United Kingdom (U.K.) for the period 1958-1974. Nickell hypothesized that manufacturing employment is a function of industrial output, investment in plant and machinery, earnings, effective price of capital goods, output prices, real share prices, and M3 money supply.

There is substantial disagreement among economists about the effect of trade on manufacturing employment. Papers by Yang (2021) and Pierce and Schott (2016) are indicative of this disagreement. Yang used an instrumental variable approach and found that U.S. exports to different markets created more than 1.6 million manufacturing jobs between 1991 and 2007. Pierce and Schott found that the sharp drop in US manufacturing employment after 2000 was strongly affected by a change in U.S. trade policy that eliminated potential tariff increases on Chinese imports.

Acharya (2017) estimated the impact of imports on Canada's level of employment, skill structure, and wages by level of education for the period 1992-2007. Achara stated that "In particular, we decompose the effects

of trade based on Canada's three major trading partners (USA, China and Mexico) to determine whether increasing trade with emerging economies has significantly altered labour market outcomes." Acharya found that imports affected only about 6,000 jobs annually.

4. Data Discrepancies

There are two general methods used by various countries to report employment data: survey results and recorded data. The U.S. Bureau of Labor Statistics (BLS) conducts a monthly survey (Current Employment Statistics) of business establishments in the U.S. The BLS has explained that: (United States Bureau of Labor Statistics 2021)

> The Current Employment Statistics (CES) survey is based on a sample of 651,000 business establishments nationwide. The survey produces monthly estimates of employment, hours, and earnings for the Nation, States, and major metropolitan areas.

Because the BLS uses survey data, it does not consider administrative data such as the number of people who receive unemployment benefits. (Carey, 2021) The BLS use of survey data may cause their results to be biased, although the amount of bias is probably small due to the large number of observations in their study.

5. The Variables

The following variables were taken from the literature review consumption, government spending, Gross National Product (GNP), international trade, investment, the minimum wage, money supply, the non-manufacturing employment percentage, nonresidential fixed investment, labor productivity, taxation, and government spending.

5.1. Consumption

There are two variables that can be used to measure domestic consumption: personal consumption expenditures (PCE) and personal consumption expenditures less food and energy (PCELFE). Proponents of the use of PCELFE argue that food and energy consumption is more volatile than PCE and that the use of PCE may present a biased picture of domestic consumption.

Over the monthly period 1959:1 to 2021:12, PCE has a mean of 60.46027, a standard deviation of 31.7857, and a volatility of (52.91%). PCELFE has a mean of 61.78117, a standard deviation of 32.32358, and a volatility of 52.32%. I will use PCE in my models because it includes food and energy consumption and because there is only a minor difference between the volatility of the two series. The summary results of these two series are given in Figures 1 and 2 below.

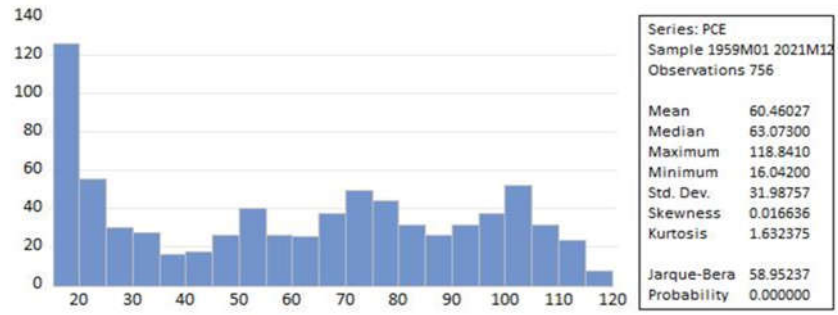

Figure 1. Histogram and Summary Statistics of PCE

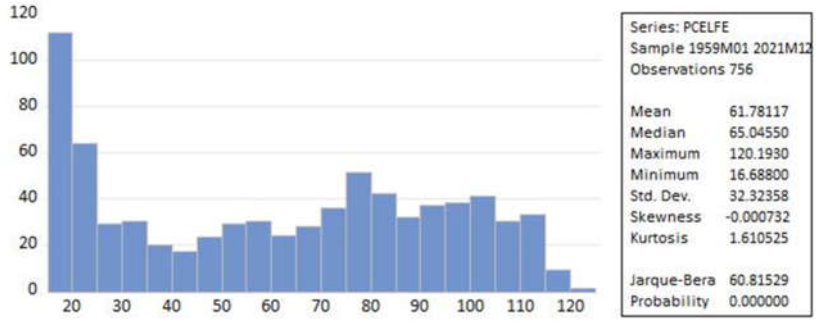

Figure 2. Histogram and Summary Statistics of PCELFE

5.2. Government Spending

A review of economic theory indicates that an increase in government spending might have three major effects on employment. First, it increases employment by putting more money into the economy; second, it crowds out private investment; and third, it increases inflation which in turn decreases employment.

The BLS publishes three variables that measure government spending: federal government current expenditures (FCE), government total expenditures (GTE), and federal government consumption and gross investment (GCI). Government consumption and investment is used in the calculation of both gross national product and gross domestic product. An explanation of the differences in the three variables is given in Table 1 below.

Table 1. Government Spending Variables

Variable	Includes	Data Starts
Federal Current Expenditures (FCE)	Federal government consumption expenditures, plus spending on social benefits and other transfer payments, interest payments, and subsidies to businesses.	1947 Q1
Government Total Expenditures (GTE)	All expenditures of the federal, state, and local governments.	1960 Q1
Government Consumption and Gross Investment (GCI)	All government expenditures used to produce and provide services to the public. These include national defense, education, and highway construction.	1947 Q1

Source: U.S. Bureau of Economic Analysis (2023)

For the period 1960 Q1 to 2021 Q4, the first difference of two of the three series (FCE and GTE) are highly correlated with each other. FCE and GTE have a correlation coefficient of 0.94. However, GCI has a low correlation with FCE and GTE. The correlation coefficient between GCI and FCE is 0.32 and the correlation coefficient between GCI and GTE is 0.36. The difference is caused because GCI does not include items such as transfer payments and interest payments.

Thus, government current expenditures provide a more complete picture of total government spending than does government consumption and gross investment.

5.3. Gross National Product (GNP)

The econometric models will use GNP instead of GDP because GNP was the variable suggested by Okun (1962) in his model of the U.S. economy. Real GNP or real GDP will not be used in the models because the real value of a series is simply the nominal value of a series adjusted for inflation. Since inflation (as measured by CPI) will be one of the modeling variables, the use of real GDP or real GNP would mean that inflation is counted twice: once in the CPI variable and once in the real GNP or real GDP variables.

GNP is a measure of a domestic economy and GDP is a measure of an international economy. The only difference between GNP and GDP is that GDP includes net exports (exports minus imports). Measured over the period 1948 Q1 to 2021 Q4, GDP and GNP are highly correlated with a correlation coefficient of 0.97.

5.4. International Trade

Imports plus exports is used as a proxy for the value of international trade instead of net exports (exports minus imports). The former method is used by many practitioners such as First Trust Data Watch. Economists at First

Trust have recently stated that “We like to focus on the total volume of trade, imports plus exports, as it represents the extent of business and consumer interactions across the US border.” (Wesbury and Stein, 2023)

In nominal terms, U.S. net exports have been negative since 1980. As shown in Figure 3, the value of net exports as a percent of GDP is a small part of the U.S. economy and has been declining since 2005. The absolute value of net exports as a percent of GDP has ranged over time, from 2.7% in 1948 to 3.8% in 2021 Q4 with a low of 0.0% in 1950, a high of 6.0% in 2005, and a mean of 1.8%[2].

Figure 3. The value of net exports as a percent of GDP (1947-2023)

Two econometric regressions were run with the first difference of GDP as the dependent variable in order to show the full effect of international trade on GDP. Both regressions had a single independent variable, the first difference of net exports and the first difference of total trade (imports plus exports). A moving average term (MA1) was used to control the effect of serial correlation. A summary of the two regressions is provided in Table 2 and the full regression output is given in Tables A-3 and A-4 of Appendix A.

Table 2. Comparison of International Trade Regression Results

Item	Net Exports Model	Total Trade Model
Independent Variable Coefficient	-2.3757	1.4984
P-value	0.0000	0.0000
Constant term coefficient	74.1130	47.9734
P-value	0.0000	0.0000
Durbin-Watson statistic	1.9570	1.8600
R-squared	0.1220	0.7254
F-statistic p-value	0.0000	0.0000

Source: Author

[2] Source: Bureau of Economic Analysis 2023, calculations by author.

As shown in Table 2, the total trade model captures over 72% of the variance of the first difference of GDP compared to 12% in the net exports model. In 2021 Q4, the first difference in GDP was approximately $798 billion and the first difference in net exports was minus $25 billion or approximately 3% of the first difference of GDP. The net export model indicates that the net exports coefficient was -2.38, which equates to a negative effect of approximately $59.5 billion on GDP in 2021 Q4.

In 2021 Q4, the first difference of total trade was $362 billion or approximately 45% of the first difference of GDP. The total trade model indicates that trade (imports plus exports) increased GDP by approximately $546 billion compared to $59.5 billion for the net exports model.

5.5. Investment

Total private investment can be estimated as the sum of two variables: private residential fixed investment and private nonresidential fixed investment. Private residential fixed investment (RFI) consists of purchases of private residential structures and residential equipment that is owned by landlords and rented to tenants. Private nonresidential fixed investment (NFI) consists of purchases of nonresidential structures, equipment, and software. (Bureau of Economic Analysis, 2023)[3]

In 2021, total private investment (NFI+RFI) was approximately $4.302 trillion and nominal GDP was $26.137 trillion. Thus, total private investment constituted 16.46% of nominal GDP. For the period 1948 Q1 to 2021 Q4, the nominal values of RFI and NFI had a correlation of approximately 0.94.[4] The first difference of these two series has a correlation of only 0.11. This implies that quarterly changes in these two series tend to move in opposite directions. This was true in 106 out of 292 quarters in the study.

NFI's share of total investment has grown from 58.34% in 1950 to 73.33% in 2021, although NFI has declined from a high of 83.70% in 2011. RFI is primarily housing investment and housing investment is sensitive to changes in interest rates as shown in Figure 4. If RFI rises more than NFI in a given period, then NFI's share of total investment will decline.

[3] NFI is one of the proxies for expected demand.

[4] The nominal values of NFI and RFI are non-stationary series. Thus, using only the nominal values to estimate correlation may yield a biased estimate of the correlation between the two series.

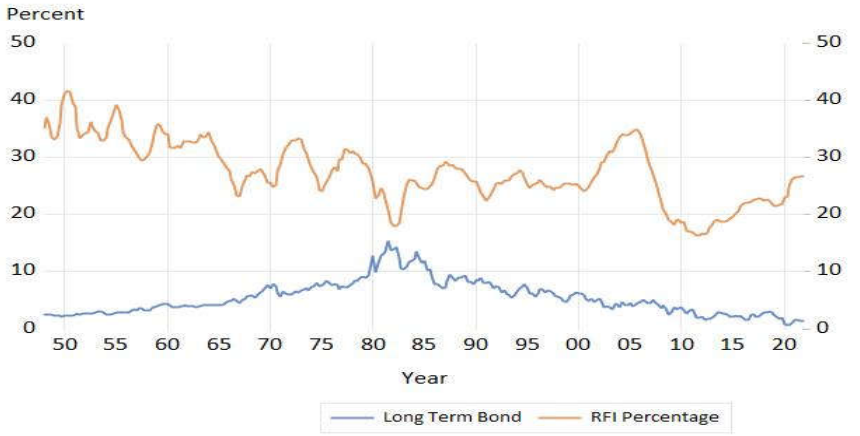

Figure 4. The long-term bond yield and the RFI percentage (1948-2021)

5.6. The U.S. Federal Minimum Wage

The effect of the federal minimum wage variable is difficult to estimate in a first difference model because of a lack of variance in the series and the small number of minimum wage workers. The United States Bureau of Labor Statistics (BLS) has reported that 181,000 workers earned the minimum wage in 2021, and 910,000 workers earned less than the minimum wage compared to a total of 149.2 million employed workers. Thus, minimum wage workers account for less than 0.8% of all workers in the United States. (Bureau of Labor Statistics, 2022)

The U.S. last increased the federal minimum wage in 2009. Thus, the first difference of the minimum wage series is zero in many quarters. Out of 296 quarters in the study, the first difference in the minimum wage variable was zero in 271 quarters. A history of changes to the minimum wage is provided in Table 3 below.

The United States established a federal minimum wage of $.25/hour when President Franklin Roosevelt signed the Fair Labor Standards Act (FLSA) in 1938.[5] The federal minimum wage has increased from $0.25/hour in 1938 to $7.25/hour in 2023 for eligible employees.

In 1961, minimum wage coverage was extended to employees in large retail and service enterprises, local transit, construction, and gasoline service station employees. The 1966 amendments extended coverage to state and local government employees of hospitals, nursing homes, and schools;

[5] The FLSA was only applicable to employees engaged in interstate commerce or in the production of goods for interstate commerce. The FLSA has been amended several times since 1938 and coverage has been expanded.

and to laundries, dry cleaners, large hotels, motels, restaurants, and farms. Subsequent amendments extended coverage to uncovered federal, state, and local government employees, certain workers in retail and service trades, and to domestic workers in private households. Table 3 provides a history of changes to the federal minimum wage in the United States.

Table 3. History of Changes to the U.S. Federal Minimum wage

Effective Date	Hourly Rate ($)	Hourly Rate Increase (%)	Inflation Rate Increase (%)
October 24, 1938	$0.25	NA	NA
October 24, 1939	$0.30	20.00%	NA
October 24, 1945	$0.40	33.33%	NA
January 25, 1950	$0.75	87.50%	9.91%
March 1, 1956	$1.00	33.33%	11.38%
September 3, 1961	$1.15	15.00%	11.47%
September 3, 1963	$1.25	8.70%	2.71%
February 1, 1967	$1.40	12.50%	6.99%
February 1, 1968	$1.60	14.29%	3.65%
May 1, 1974	$2.00	25.00%	45.76%
January 1, 1975	$2.10	5.00%	7.90%
January 1, 1976	$2.30	9.52%	7.13%
January 1, 1978	$2.65	15.22%	12.05%
January 1, 1979	$2.90	9.43%	8.99%
January 1, 1980	$3.10	6.90%	13.25%
January 1, 1981	$3.35	8.06%	12.35%
April 1, 1990	$3.80	13.43%	50.23%
April 1, 1991	$4.25	11.84%	4.82%
October 1, 1996	$4.75	11.76%	16.99%
September 1, 1997	$5.15	8.42%	1.97%
July 24, 2007	$5.85	13.59%	28.88%
July 24, 2008	$6.55	11.97%	4.94%
July 24, 2009	$7.25	10.69%	-1.22%
December 31, 2021	$7.25	0.00%	30.77%

Source: U.S. Bureau of Labor Statistics

As shown in Table 3, increases to the minimum wage (in percent) exceeded the inflation rate in most periods prior to the last increase in the minimum wage in 2009. Inflation has increased by 30.77% with no increase to the minimum wage from 2009-2021. Thus, the real minimum wage in 2021 dollars is only $5.54/hour.

As a result, the current U.S. minimum wage is not high enough to allow workers to maintain an adequate standard of living.[6] However, it is higher than the minimum wage in twenty of the twenty-seven countries in the European Union. (Eurostat, 2023). Only seven European Union countries have a minimum wage higher than the U.S. minimum wage. These countries are Belgium, France, Germany, Ireland, Luxembourg, the Netherlands, and Spain.

5.7. Money Supply

Money supply (also referred to as money stock) is the total of all the currency and liquid assets in a country's economy on a particular date. In their undergraduate textbook, Hall and Taylor present a short-run growth model in which the growth in the price level is equal to the growth of money supply. (Hall and Taylor, 1993, p. 136) Of course, the operations of the money market are far more complex than the short-run model presented by Hall and Taylor. Table 4 provides a description of the different ways that money supply is measured and the available data for each method.

Table 4. Types of Money Supply and the availability of data on each variable

Type	Includes	Data Availability	Correlation with M3
M0	Notes and coins in circulation	None[7]	NA
MB	M0 plus note and coins in bank vaults and Federal Reserve Bank credit[8]	None	NA
M1	M0 plus travelers checks of non-bank issuers (e.g., American Express), demand deposits, checkable deposits, and savings deposits.	1959:Q1 to 2023:Q2	0.74
M2	M1 plus time deposits of less than $100,000 and individual money market deposit accounts[9]	1959:Q1 to 2017:Q1	0.99
M3	M2 plus large time deposits, institutional money market funds, short-term repurchases, and other larger liquid assets	1948:Q1 to 2023:Q1	1.00
MZM	M1 plus all money market funds	1980:Q4 to 2021:Q1	0.84

Source: Federal Reserve Bank of St. Louis (2022)

[6] A minimum wage worker will earn $15,080 annually if they work 2,080 hours per year (40 hours per week multiplied by 52 weeks). The federal poverty level for a single person is $14,580 per year in the lower 48 states, $16,770 in Hawaii, and $18,210 in Alaska. (Reed, 2023)

[7] M0 (monetary base) is not published in the United States although it is included in other measures of money supply.

[8] MB is the most liquid measure of money supply.

[9] M2 is a key economic indicator used to forecast inflation.

The correlations given in Table 4 are for the first difference of the variables for the period 1980 Q4 to 2017 Q1. This time period was chosen because this was the only time period in which data was available for all of the variables. All of the measures of money supply are highly correlated with M3, with correlation coefficients ranging from 0.74 to 0.99.

The econometric models will use M3 to measure money supply because it is the broadest measure of money supply and because M3 data is available for the entire length of the study (1948 Q1 to 2021 Q4).

5.8. Manufacturing Employment

The percentage of employees employed in manufacturing (MEP) has fallen from 32.15% in 1948 to 8.41% in 2021. The non-manufacturing employment percentage is 1 – MEP. As shown in Figure 5, the MEP has been relatively stable since 2011, falling only forty-eight basis points, from 8.89% to 8.41%.

The MEP declined significantly in every decade until 2010 when it stabilized at under 9%. Both the MEP and the number of manufacturing employees have fallen over the length of this study. By the end of 1978, there were 19.334 million manufacturing employees. By 2021, there were only 12.555 million, a loss of almost seven million manufacturing jobs.

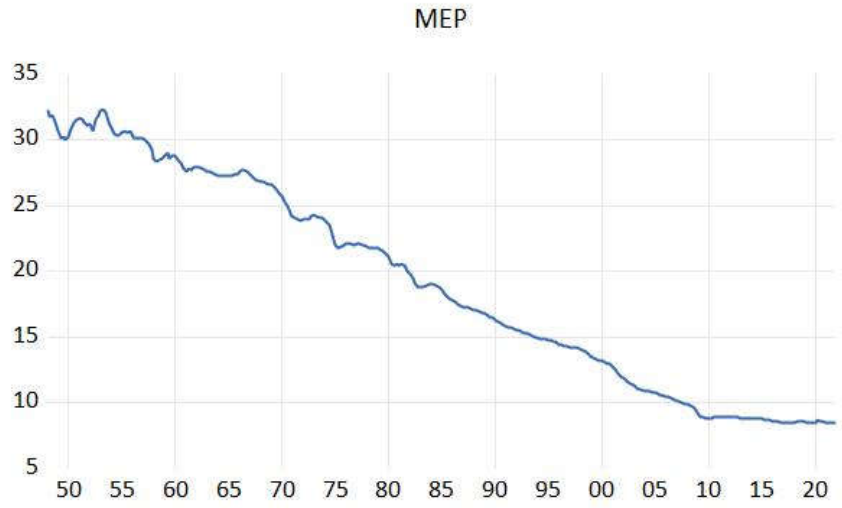

Figure 5. The percentage of workers employed in manufacturing (1948-2021)

The decline both in the MEP and in manufacturing employment has been affected by technological change, innovation, and productivity as manufacturers needed fewer workers to produce the same level of output. (See Gruss and Natova, 2018) However, the primary cause of the decline in MEP has been the change in U.S. trade policy since 1948. At that time, the U.S. was almost a closed economy as measured by the import percentage (Imports/GNP).

The import percentage rose from 3.6% in 1948 to 17.1% in 2011 and then fell to 14.9% in 2021. The decline in imports as a percent of GNP has been a major contributor to the stabilization of MEP since 2011.[10] Figure 6 provides a comparison of the percent of imports with the MEP. It shows that as the percentage of imports rose, the MEP fell.

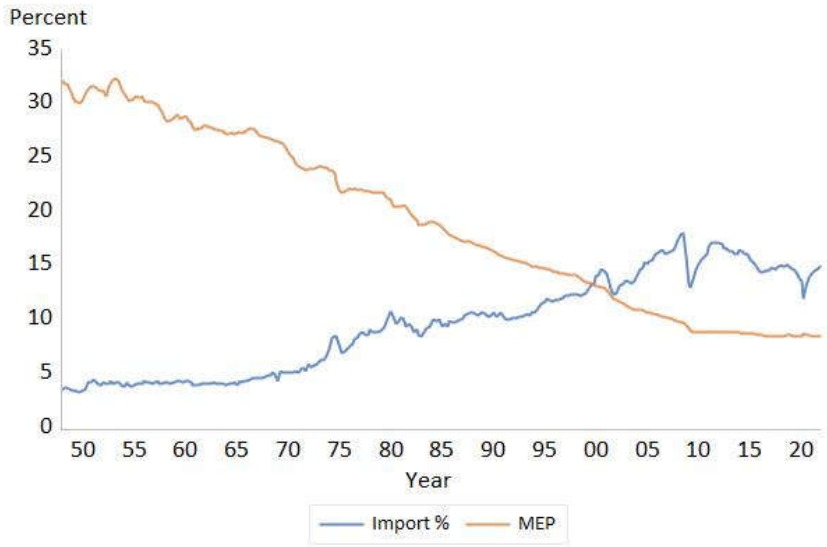

Figure 6. Imports and the MEP

5.9. Labor Productivity

Labor productivity is nominal GDP divided by total hours worked. Labor productivity has fallen by about 2% since 2021 Q2. Figure 7 provides a graph of a seasonally adjusted index (2012=100) of labor productivity from 1948 to 2023.

[10] The MEP fell only 47 basis points during this decade from 8.88% in 2011 to 8.41% in 2021.

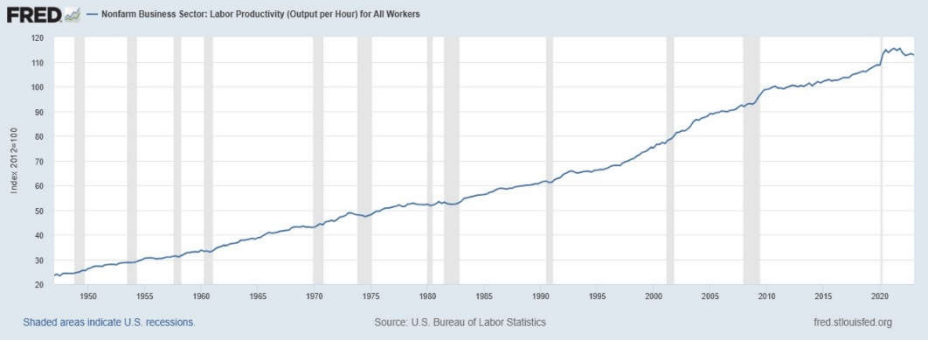

Figure 7. Labor Productivity Index (1948-2023)

Kenton (2023) has explained that "Labor productivity growth comes from increases in the amount of capital available to each worker (capital deepening), the education and experience of the workforce (labor composition), and improvements in technology (multi-factor productivity growth)."

Kenton argues that "Investment in an economy is equal to the level of savings because investment has to be financed from savings. It is only when monetary policy is tightened, and rates rise that the economy encourages saving and ultimately future investment." Unfortunately, the data does not support Kenton's arguments.

In 2022, gross savings were approximately $5.2 trillion compared to total private investment of approximately $8.9 trillion, a difference of over 70%. For the period 1948 to 2022, gross savings averaged approximately $1.5 trillion compared to an average of $1.2 trillion in private investment, a difference of 25%.

As measured by the long-term bond yield, interest rates rose from 1948 Q1 (2.44%) to 1981 Q3 (15.32%) and then fell to 0.68% in 2020 Q3. The savings rate (Gross Savings/GNP) rose from 16.27% in 1948 to 23.27% in 1981 and then rose to 30.67% by 2020. The savings rate increased by 700 basis points when interest rates were increasing and rose by 740 basis points when interest rates were declining. The correlation between the savings rate and interest rates is only .001875, which indicates that changes in interest rates have almost no effect on savings.

5.10. Taxation

The U.S. Internal Revenue Service is the federal agency responsible for administering the U.S. tax code. Many economics papers have used the marginal tax rate as a proxy for taxation. The current U.S. federal individual marginal tax rate ranges from 10% to 37% depending on an individual's adjusted gross income. The top marginal tax rate was over

90% in the 1950s. However, the effective tax rate was only 16.9%. (Greenberg, 2017)

This paper uses government total receipts (GTR) as a proxy for taxation because GTR provides a more accurate picture of the tax burden faced by individuals and businesses. In 2022, federal income taxes were $1.7 trillion (York, 2023) and total federal tax receipts were approximately $3.2 trillion. Thus, income taxes constituted about 53% of total federal government tax receipts.

Messerli (2011) has identified over 100 different taxes. In his article, Messerli quotes Robert Brault's joke that the "U.S. Internal Revenue Service: [is] an agency modeled after the revenue raising concepts of the 19th century economist, Jesse James".[11] - Robert Brault.

The marginal tax rate provides an incomplete picture of the amount of taxes paid by Americans and thus an incomplete picture of the amount of disposable income. Disposable income can be saved, used to consume goods and services, or invested. Therefore, models that rely on the marginal tax rate could yield biased estimates of other macroeconomic variables such as GDP, consumption, or investment.

The effective tax rate is total taxes paid divided by total income. The effective tax rate is much lower than the marginal tax rate, because of the number of deductions, exemptions, and credits that can be claimed both by individual and by corporate taxpayers. For example, all individual taxpayers who file a joint return receive a standard deduction of at least $25,000 ($30,500 for people over 65).

Other deductions and credits for individual taxpayers who do not itemize deductions include contributions to an individual retirement account, exempt interest, exemptions related to social security benefits and pensions, qualified business income deductions, child care credit, education deductions and credits, educator expenses, health savings account deduction, health insurance deduction, self-employment tax deduction, student loan interest deduction, alimony deduction, foreign tax credit, and the residential energy credit.

Taxpayers who itemize deductions do not receive the standard deduction. However, they can claim deductions for medical and dental expenses, state and local taxes, home mortgage interest, investment interest paid, charitable contributions, casualty and theft losses, and job-related expenses such as uniforms and union dues. Small businesses can claim deductions for all reasonable expenses incurred, automobile expenses, depreciation and amortization, and expenses incurred for business use of their home.

[11] Jesse James was an infamous 19th century pro-slavery outlaw from the state of Missouri.

Conclusion

This paper has provided a theoretical model of employment and an analysis of the macro variables that some economists believe influence total employment in the United States. The paper compared the mean of the first difference of aggregate employment (EMP) with the estimated value of aggregate employment (ESTE). The theoretical model provides a good approximation of the mean of the two series. ESTE has a mean of 352.6206 compared to a mean of 354.4305 for EMP (a difference of only 0.5%).

An analysis of the variables indicates that:

- There is only a minor difference between the volatility of personal consumption expenditures and the volatility of personal consumption expenditures minus food and energy.
- In nominal terms, U.S. net exports have been negative since 1980. The absolute value of net exports as a percent of GDP is a small part of the U.S. economy and has been declining since 2005. The absolute value of net exports as a percent of GDP has ranged over time from 2.7% in 1948 to 3.8% in 2021 Q4 with a low of 0.0% in 1950, a high of 6.0% in 2005, and a mean of 1.8%.
- Nonresidential Fixed Investment (NFI's) share of total investment has grown from 58.34% in 1950 to 73.33% in 2021, although NFI has declined from a high of 83.70% in 2011.
- Minimum wage workers account for less than 0.8% of all workers in the United States. (Bureau of Labor Statistics 2022b) The current U.S. minimum wage is not high enough to allow workers to maintain an adequate standard of living. However, it is higher than the minimum wage in twenty of the twenty-seven countries in the European Union.
- The percentage of manufacturing employees (MEP) has fallen from 32.15% in 1948 to 8.41% in 2021. The MEP has been relatively stable since 2011, falling only forty-eight basis points, from 8.89% to 8.41%. The primary cause of the decline in MEP has been the change in U.S. trade policy since 1948. At that time, the U.S. was almost a closed economy as measured by the import percentage (Imports/GNP).
- As measured by the long-term bond yield, interest rates rose from 1948 Q1 (2.44%) to 1981 Q3 (15.32%) and then fell to 0.68% in 2020 Q3. The savings rate (Gross Savings/GNP) rose from 16.27% in 1948 to 23.27% in 1981 and then rose to 30.67% by 2020. The savings rate increased by 700 basis points when interest rates were increasing and rose by 740 basis points when interest rates were declining. The correlation between the savings rate and interest rates is only .001875, which indicates that changes in interest rates have almost no effect on savings.

- Government total receipts (GTR) is a better proxy for taxation than the marginal tax rate because GTR provides a more accurate picture of the tax burden faced by individuals and businesses. In 2022, federal income taxes were $1.7 trillion (York, 2023) and total federal tax receipts were approximately $3.2 trillion. Thus, income taxes constituted approximately 53% of total federal government tax receipts.

The paper found that PCE is a better proxy for consumption than PCELFE because PCE includes all personal consumption. Government current expenditures (GCE) is the best proxy for government spending because GCE includes spending by all levels of government: federal, state, and local. Total trade (imports plus exports) is a better proxy for international trade than net exports because imports plus exports captures the true value of international trade on the U.S. economy.

M3 is the best proxy for money supply because it is the broadest measure of money supply and because M3 data is available for the entire length of the study (1948 Q1 to 2021 Q4). Finally, the paper found that Government total receipts (GTR) is a better proxy for taxation than the marginal tax rate because GTR provides a more accurate picture of the tax burden faced by individuals and businesses.

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Appendix A

Table A-1. The Expected Demand Risk Factor

Dependent Variable: DEMP
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 11/04/23 Time: 23:37
Sample (adjusted): 1948Q2 2021Q4
Included observations: 295 after adjustments
Convergence achieved after 45 iterations
Coefficient covariance computed using outer product of gradients
MA Backcast: 1948Q1
Presample variance: backcast (parameter = 0.7)
GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(GARCH)	-283.1912	77.79020	-3.640448	0.0003
C	3369.276	901.3517	3.738026	0.0002
DNFI+DPCE	5.984439	0.129360	46.26196	0.0000
MA(1)	0.609121	0.056442	10.79206	0.0000
Variance Equation				
C(5)	9690.060	8362.471	1.158756	0.2466
RESID(-1)^2	0.213582	0.191421	1.115773	0.2645
GARCH(-1)	0.723222	0.244812	2.954200	0.0031
D	0.785238	0.440471	1.782724	0.0746

R-squared	0.767474	Mean dependent var	354.4305
Adjusted R-squared	0.765076	S.D. dependent var	990.2822
S.E. of regression	479.9790	Akaike info criterion	14.93413
Sum squared resid	67040545	Schwarz criterion	15.03411
Log likelihood	-2194.784	Hannan-Quinn criter.	14.97416
Durbin-Watson stat	1.917029		

Inverted MA Roots	-.61

Table A-2. The Effect of GNP on Non-Farm Employment in the United States
Dependent Variable: @PCH(EMP)
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 12/01/21 Time: 13:54
Sample: 1948Q2 2021Q2
Included observations: 293
Convergence achieved after 16 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.003171	0.000464	-6.840449	0.0000
@PCH(GNP)	0.416702	0.014375	28.98843	0.0000
AR(1)	-0.041145	0.054530	-0.754534	0.4511
SIGMASQ	3.91E-05	2.13E-06	18.32298	0.0000

R-squared	0.470095	Mean dependent var	0.003342
Adjusted R-squared	0.464594	S.D. dependent var	0.008606
S.E. of regression	0.006297	Akaike info criterion	-7.283855
Sum squared resid	0.011460	Schwarz criterion	-7.233613
Log likelihood	1071.085	Hannan-Quinn criter.	-7.263732
F-statistic	85.46017	Durbin-Watson stat	1.989493
Prob(F-statistic)	0.000000		
Inverted AR Roots	-.04		

Table A-3. The effect of Total Trade (Imports plus Exports) on GDP in the United States

Dependent Variable: DGDP
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 06/16/23 Time: 02:51
Sample: 1948Q2 2021Q4
Included observations: 295
Convergence achieved after 128 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	49.97338	8.872743	5.632235	0.0000
DTRADE	1.498387	0.012324	121.5817	0.0000
MA(1)	0.265573	0.021138	12.56384	0.0000
SIGMASQ	9285.001	337.8333	27.48397	0.0000

R-squared	0.725378	Mean dependent var	81.63857
Adjusted R-squared	0.722547	S.D. dependent var	184.1879
S.E. of regression	97.01871	Akaike info criterion	12.00140
Sum squared resid	2739075.	Schwarz criterion	12.05139
Log likelihood	-1766.206	Hannan-Quinn criter.	12.02142
F-statistic	256.2134	Durbin-Watson stat	1.859993
Prob(F-statistic)	0.000000		

Inverted MA Roots	-.27

Table A-4. The effect of Net Exports (Exports minus Importson GDP in the United States

Dependent Variable: DGDP
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 06/16/23 Time: 02:47
Sample: 1948Q2 2021Q4
Included observations: 295
Convergence achieved after 250 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	74.11299	13.15624	5.633295	0.0000
DNE	-2.375667	0.314496	-7.553892	0.0000
MA(1)	-0.049117	0.024791	-1.981273	0.0485
SIGMASQ	29686.34	560.3213	52.98092	0.0000

R-squared	0.121970	Mean dependent var	81.63857
Adjusted R-squared	0.112918	S.D. dependent var	184.1879
S.E. of regression	173.4774	Akaike info criterion	13.16345
Sum squared resid	8757469.	Schwarz criterion	13.21344
Log likelihood	-1937.608	Hannan-Quinn criter.	13.18346
F-statistic	13.47462	Durbin-Watson stat	1.957016
Prob(F-statistic)	0.000000		

Inverted MA Roots	.05