ECONOMICS 620

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Inflationary Trends : Underlying Determinates

Over the Business Cycle

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Inflationary Trends : Underlying Determinates

Over the Business Cycle

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I hereby recognize and pledge to fulfill my responsibilities as defined in the Honor Code and to maintain the integrity of both myself and the College as a whole.

Your Signature

Your Name: Edward Bacon

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Abstract

The inflation rate is considered a critical measure of an economy's health. Therefore, understanding what determines inflation and understanding how inflation correlates to other economic measures is an important objective in developing a strategy to maintain a stable economy. This paper first analyzes the historical trends of inflation, events such as the oil shocks of the 1970's and the hyperinflation in Germany that occurred after World War I. This paper then reviews the theories and models of inflation, including the Phillips curve, which is the relationship between unemployment and the inflation rate, as well as the aggregate demand price adjustment model, which examines the relationship between the price level and deviations of GDP from potential. Finally, regression analysis is used to provide insight on the quantitative relationships between the economic elements that cause inflation and the strength of these relationships. These three components are combined to explain historical episodes of inflation and to offer explanations for inflationary changes throughout economic cycles.

Chapter 1

Inflationary Trends: An Overview

1.1 Introduction

The purpose of this paper is understand the determinates of inflation and how inflation has moved over time due to changes in these determinates; that is, to examine the historical trends and to see how inflation is correlated with other measures of the economy, as well as to examine how this correlation has changed over time. Inflation is the growth rate in the price level of goods and services in an economy between two time periods. Inflation causes the buying power of each dollar to decrease, since goods cost more. Examining the percentage rate of change in the price level from year to year allows economists to see patterns and to look for reasons as to why the inflation rate increases and decreases the way it does. Inflation is one of the most watched economic measures because economists and policy makers see it as one of the biggest problems should it get out of control (Leo 1-26-12). This chapter examines historical inflationary episodes and shows strong evidence that periods of higher inflation are disruptive to the economy, which are often resolved by periods of recessionary correction. Specifically section 1.2 introduces the inflation rate and the different measurements of inflation. Section 1.3 looks at the social costs of inflation, such as hyperinflation, through analysis of historical episodes. Section 1.4 examines the oil shocks that have led to cost-push inflation. Section1.5 expands on the Phillips curve and section 1.6 concludes the chapter.

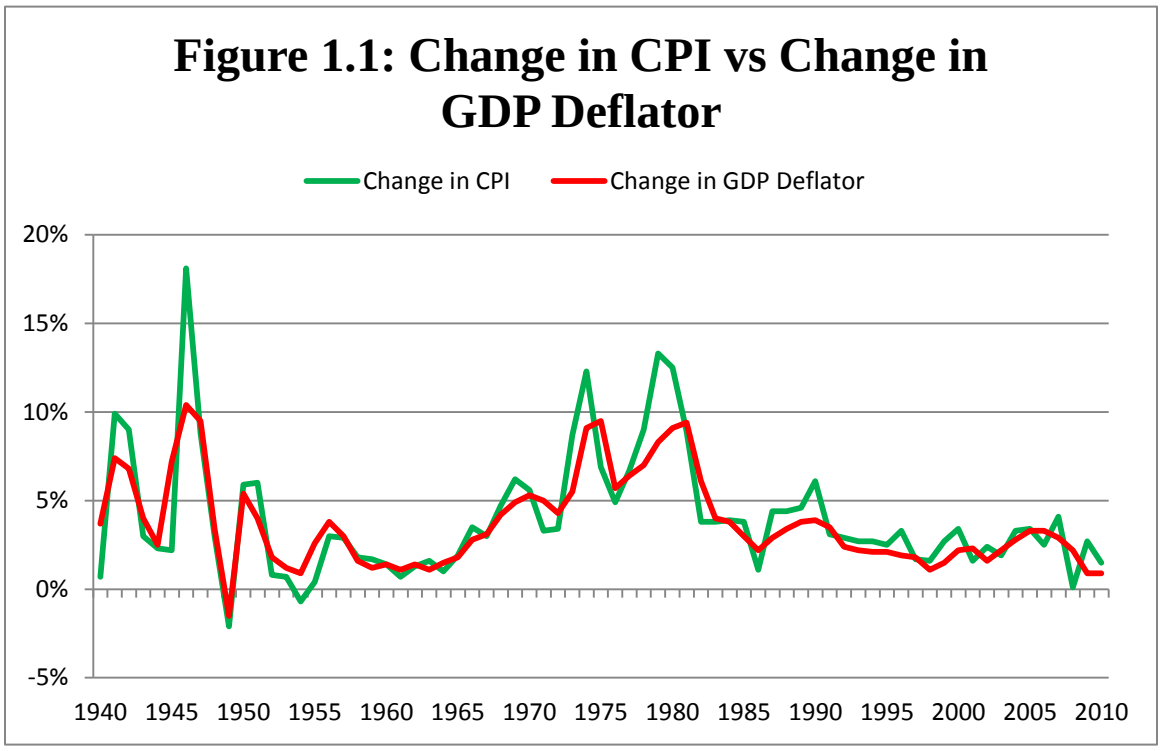
1.2 Inflation Rate Defined and Profiled

The inflation rate is generally monitored through either the consumer price index (CPI) or the Gross Domestic Product (GDP) deflator. The CPI is a measure of the average prices of

goods and services bought by households in any given year. Its growth rate is a measure of inflation, which shows how the prices of consumer goods change. The CPI uses a "market basket" to set a baseline of goods whose prices are checked periodically to determine if inflation is occurring. This market basket has changed through the years as new products are added and obsolete products are removed. The CPI is essentially a cost of living measurement for consumers that shows the cost level for the goods and services that make up the majority of their needs (Fixler, 1993). The GDP deflator is a measure of the prices of all new, domestically produced goods in the economy in a year. Gross Domestic Product is the value of all goods produced domestically in a year, and therefore extends beyond the CPI to include wholesale prices among businesses (Fixler, 1993).

Figure 1.1 displays the growth rate of CPI and the GDP deflator and shows that the two are closely related, following similar upward and downward paths for a long period of time, in this case from1940 to the present. The two are essentially the same with the exception of a few periods when the CPI is more volatile. The early periods when the CPI is materially higher than the GDP deflator occur in 1942-1943 and also 1947-1950. Both of these periods of high inflation were influenced by World War II and its aftermath. This higher CPI growth during these periods shows that the consumers were experiencing more inflation than the economy as a whole. As Figure 1.1 shows, the 1970s were the time period with the most volatility in inflation. Inflation has historically ranged between zero and five percent for 50 out of the 70 previous years. But the inflation spiked above 5% during the oil shocks of the 1970s, reaching double digits at several times. The following section takes a closer look at these oil shocks and

their implications for inflation.



http://www.gpoaccess.gov/eop/tables11.html
http://cost.jsc.nasa.gov/inflateGDP.html

1.3 The Social Costs of Inflation

When the inflation rate exceeds 5%, the economy experiences significant difficulties. For example, in the 1970s and early 1980s the oil shocks resulted in long lines at gasoline stations, government intervention with wage/price controls, double-digit interest rates and a vicious cycle of inflationary expectations that resulted in long term contracts adding cost of living indexes for inflation—thereby perpetuating such inflation. It took a prolonged recession in the early 1980s to finally bring inflation back into line. One of the costs of inflation is due to the time lag involved for the market to recalibrate wages. Those persons who are involved in longer term contracts often have the most to lose as their wage adjustment may not occur until their current project is finished or their contract expires. There is an unfair shift in the ability to consume for whoever has the current price advantage. Gardner Ackley (1978) contends that this

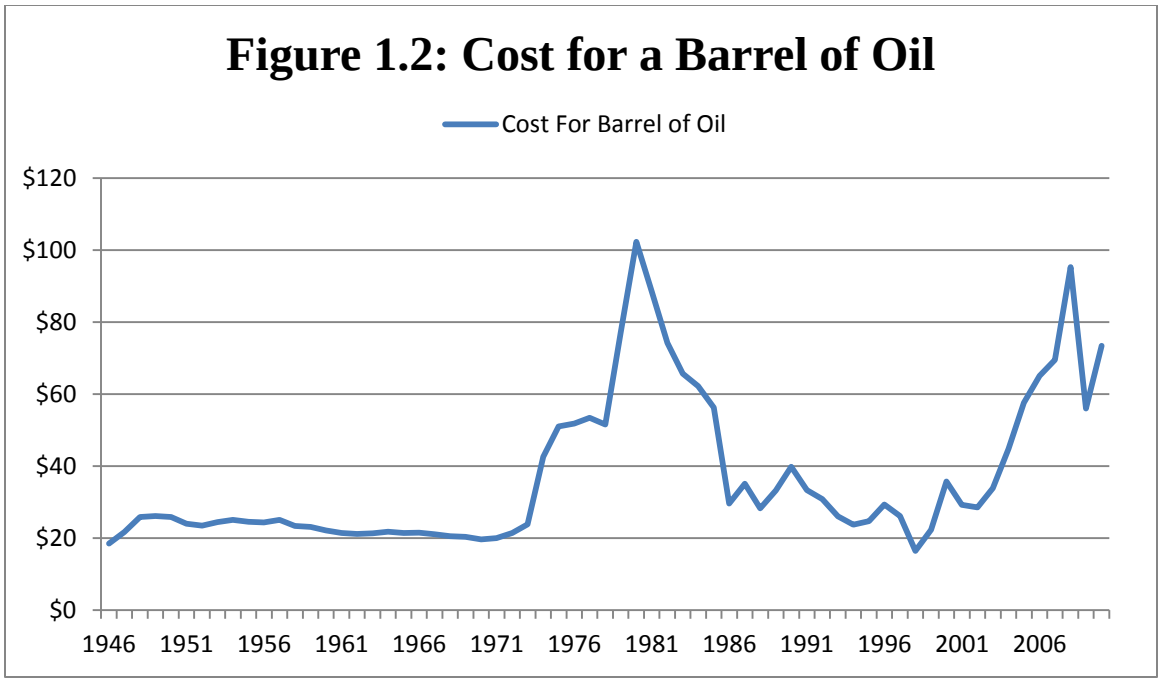
situation creates social unrest in his article *The Costs of Inflation*. "All income redistributions, whether among classes or individuals, increase personal insecurity and lessen personal satisfactions… and heighten interpersonal and institutional tensions. Thus they are destructive of the social and political fabric, and ultimately of economic efficiency" (Ackley p. 151). Another cost of inflation comes after wage adjustments take place. Increased wages, although increasing in real consumer spending power, causes an increase in real tax rates as the individual taxpayer moves up in tax brackets.

These different costs of inflation are extreme in the event of hyperinflation, which is when the inflation rate is extremely high or out of control. Although hyperinflation has never occurred in the United States, it has occurred in other countries at different points in time. One of the most well-known hyperinflation episodes occurred in Germany from July 1922-October 1923 and was examined in *The German Hyperinflation and the Demand for Money Revisited*. Before this hyperinflation, the Mark to Dollar exchange rate had already started to depreciate and was at 272 Marks to 1 US Dollar. The country might have been able to recover, but the assassination of the Foreign Minister of Germany, Walther Rathenau, caused further uncertainty and depreciation of the Mark, with the Mark to Dollar exchange increasing to 1725 Marks to 1 US Dollar in August (Michael p. 4). Hyperinflation along with other economic crises causes social unrest which was a serious problem during this time. There was so much social unrest that historians believe that it allowed the Nazi party to increase its power and influence and later led to the rise of Adolf Hitler (Wein, 2010). Despite the social problems, economic restructuring and currency reform were necessary and the German government switched from the Mark to the Rentenmark as their currency until 1948.

During times with such dramatic inflation, borrowers do much better than lenders. The borrowers get the money before the inflation hits and use it, then, by the time they need to pay the money back it is worth less because of the inflation. Times like these prove that money is not always a safe store of value since the value of the currency dropped dramatically and people who had saved their whole lives lose a significant portion of their savings. This is an extreme example of the effects of inflation; fortunately, hyperinflation doesn't occur often.

1.4 Oil Shocks Driving Cost-Push Inflation

To investigate the role of oil prices on inflation, this section examines the oil shocks that have occurred in the past. The first oil shock happened in 1973 and was a result of an OPEC oil embargo. The OPEC countries refused to sell oil to countries that had supported Israel in the Yom Kippur War of 1967, most prominently the United States (CBC, 2007). For this oil shock, the price for a barrel of oil doubled in real terms from about $20 to $40. The price remained at this higher level until the second oil shock in 1979, when the Shah of Iran, whom the United States had supported, was overthrown (CBC, 2007). The price of a barrel of oil reached $100 a barrel in real terms in 1980, five times higher than the early 1970s. Both of these shocks led the United States into recessions, first in November 1973-March 1975, then in January 1980-July 1980, and also from July 1981-November 1982. Figure 1.2 shows the history of oil prices and the large increase in the price of a barrel of oil that occurred in the 1970s. By 1986, after the recessions, oil prices retreated back to the long term range of $40 to $50 in real 2011 dollars, before spiking again in 2007/8, which was at the front end of another economic recession. The 1973 oil crisis has had lingering effects, mainly in the auto industry. Due to the oil crisis, consumer interest shifted to more fuel efficient vehicles. This shift caused Japanese auto companies to flourish and caused problems for American car companies (Cornstubble p. 1).



http://inflationdata.com/inflation/inflation_rate/historical_oil_prices_table.asp

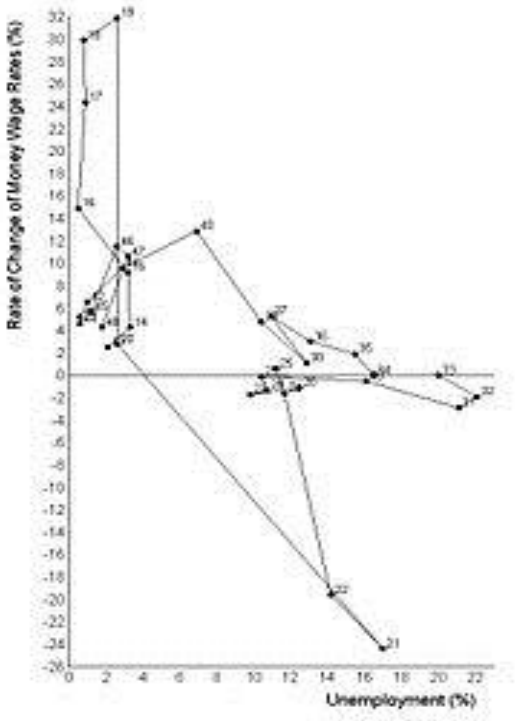
Oil prices have more impact on the CPI than the GDP deflator, explaining some of the greater volatility in the CPI as compared to the GDP deflator. Generally economists use the GDP deflator when monitoring inflation in contrast to the economy as a whole, as it reflects the broader economy beyond just the consumer. Hence, for the balance of this paper the GDP deflator will be the focus of inflation research.

1.5 The Phillips Curve

An important economic concept for understanding inflation is the Phillips curve, which asserts an inverse relationship between the inflation rate and the unemployment rate. A.W.H. Phillips came up with this relationship in his 1958 paper, "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957". In his paper, Phillips, "conjectured that the lower the unemployment rate, the tighter the labor market

and, therefore, the faster firms must raise wages to attract scarce labor" (Hoover, 2008). This inverse relationship between the change in the wage rate and the unemployment rate was the original Phillips Curve relationship. Figure 1.3 displays Phillips's work, plotting the unemployment rate along the horizontal axis with the change in wage rates plotted on the vertical axis. The relationship of higher unemployment accompanying lower wage inflation is evident. Over time, economists have taken Phillips's work and extended the relationship to broader inflation rates versus unemployment. The Phillips curve relationship can be useful when looking at economic cycles because unemployment is an important factor in the cycle and is generally inversely correlated to inflation.

Figure 1.3: The Original Phillips Curve



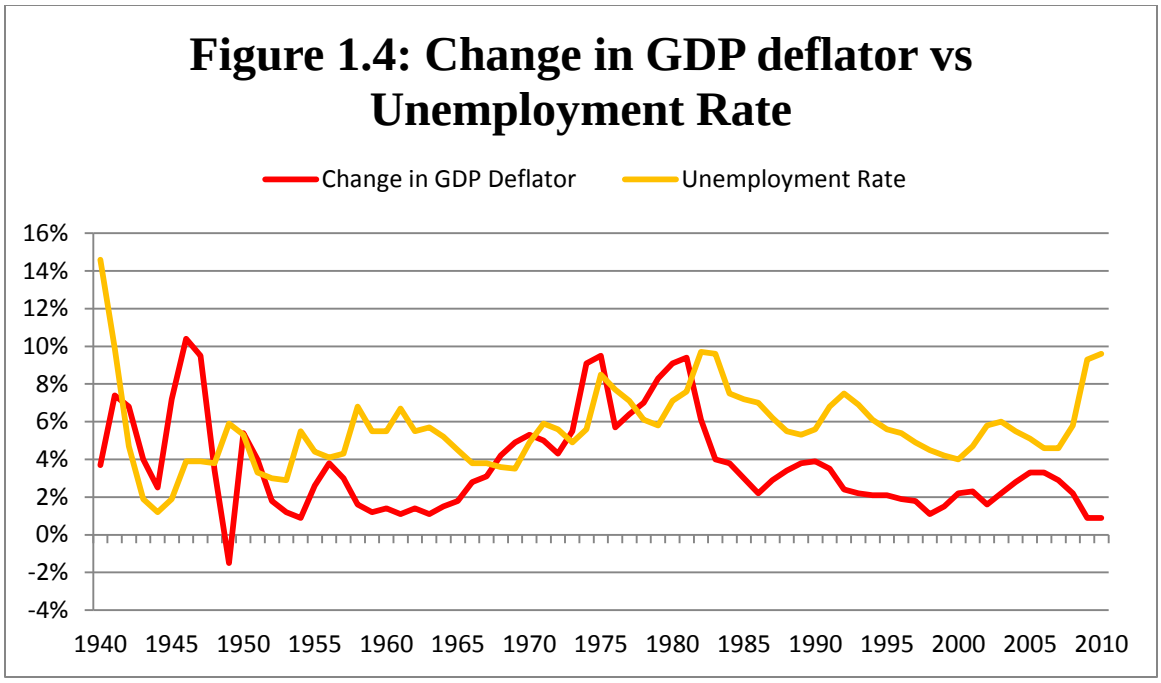
http://www.economicshelp.org/blog/1364/economics/phillips-curve-explained/

One of the problems with the Phillips curve is that it was useful and accurate when it was created but changes in the economy have subsequently shown that it has flaws. The 1970s

brought a period of high inflation and high unemployment, thereafter called "stagflation" (Hoover, 2008). During this period we saw high inflation, led by the oil price shocks discussed above, despite a sluggish economy and high unemployment. The Phillips relationship suggests that these two variables always have an inverse relationship, but stagflation shows that there can be exceptions.

In the 1960s, Milton Friedman and Edmund Phelps reexamined the Phillips curve and pointed out its flaws (Hoover, 2008). Their analysis helped to create a distinction between a short run Phillips curve and a long run Phillips curve. One of the key concepts they created was the natural rate of unemployment--that there is a rate of unemployment that the economy naturally settles into without increases or decreases in inflation. According to Friedman and Phelps, if the government tries to shift the economy below the natural unemployment level, there will be a short run decline in unemployment, but the long run result will be an increase in inflation, which will leave the economy worse off.

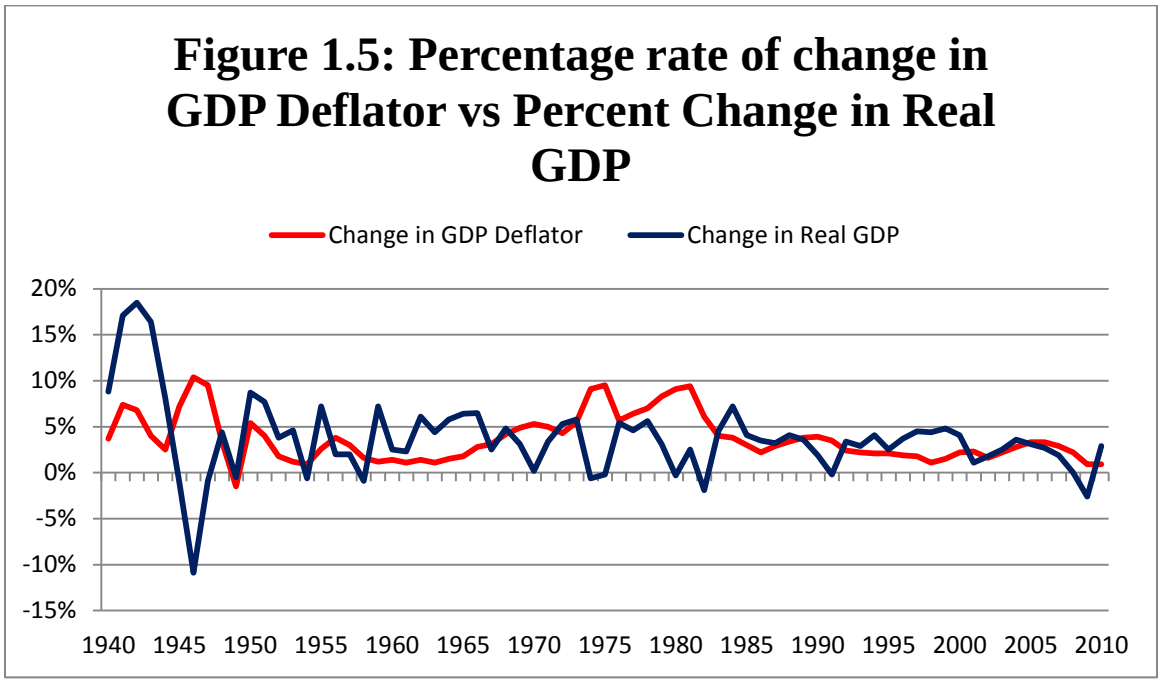
Figure 1.4 shows the GDP deflator compared to the unemployment rate; the Phillips curve relationship is generally intact. Specifically, when unemployment is high, the percentage rate of change in GDP deflator is low. This can be seen in Figure 1.4 between 1960 and 1965 with a clear Phillips curve relationship shown. This relationship is similar to what we have seen in the other figures, namely that the relationship is consistent except for the 1940s during World War II and then in the 1970s during the two oil crises. It is easiest to see in the 1970s that the Phillips relationship does not occur since instead of unemployment rate line being above the change in the GDP deflator line, the two cross back and forth.



http://www.bls.gov/cps/cpsaat1.pdf
http://www.gpoaccess.gov/eop/tables11.html

Figure 1.5 plots the GDP deflator growth against real GDP growth. We would expect that the inflation rate would increase when the economy is growing and that these two variables would be positively correlated. Both of the variables stay within the same range most of the time from 1950-1970 and also from 1985-2010. Before 1950 there are large differences because of the effects World War II had on the economy and inflation. At the peak of the war effort in 1943, inflationary pressures were rising and GDP peaked; by 1945, at the end of the war, inflation approached 10% and the GDP contracted by 10%, by any measure, a severe recession. In the 1950s, the change in GDP deflator tracked fairly closely to the change in GDP, that is, GDP growth peaked with peak inflation in 1950 and 1955. Note that upward pressure on inflation also occurs during the period of the Vietnam War, just before the oil price shocks. The period between 1975-1981 was one of the few times that the percentage rate of change in the GDP deflator was above 5%, and also during this time, real GDP growth was negative in two of the periods, indicating periods of economic recession. Looking further along the graph, there

are two periods of stagflation, one in 1975 and another in 1980. Both of these periods of stagflation have the percentage change in the GDP deflator increasing while the change in real GDP decreases. Recently, in the 2000s, both variables are decreasing with the change in real GDP decreasing much more than the percentage change in the GDP deflator.



www.bea.gov/national/xls/gdpchg.xls
http://www.gpoaccess.gov/eop/tables11.html

1.6 Conclusion

Based on this review, inflation is an important variable in the economy. While it is generally modest, ranging below 5%, there are periods when inflation rears its head and exceeds 5%. Those times seem to wreak havoc on the economy as they have tended to be times that lead into economic recession and, in turn, periods of high unemployment. As the economy expands, inflation is often under control and unemployment declines. As the economy overheats at full employment, inflation begins to kick in, which is consistent with the Phillips Curve proposition, and it takes a recession to drive down employment and bring inflation under control. The

Federal Reserve can help to control inflation but gaining control comes at a cost- recession. In 1979, Paul Volcker became the Chairman of the Federal Reserve and concentrated his efforts on lowering inflation. Volcker created policies to limit the amount of money in circulation, which was a new strategy for the fed. "We'll take the emphasis off of interest rates and put the emphasis on the growth in the money supply, which is at the root cause of inflation" (pbs.org). With these policies and less money being circulated, the inflation rate began to decrease by 1981 as the economy experienced the worst recession since the Great Depression, until then. Specific goods can also greatly affect inflation, oil has been a key commodity that singularly can drive inflation, most notably in the 1970s. With such price shocks, we see inflation even as the economy is in contraction—so called stagflation. While as yet not determining causes and effects, inflation is a key variable that is worthwhile to better understand. In the chapter that follows, the aggregate demand and price adjustment models are examined in relation to the Phillips curve from this chapter. Following this examination, in Chapter 3, statistical analysis is used to provide an in-depth examination of the variables that cause inflation.

Chapter 2

Theories That Explain Inflation

2.1 Theories and Models of Inflation

In the previous chapter, we learned about the importance of inflation as a key variable in the economy. The purpose of this chapter is to examine the macroeconomic theory behind inflation. There are two models that are helpful in examining inflation: the aggregate demand model and the price adjustment model. Aggregate demand reflects the total demand for goods and services in the economy as a function of the price level. An important component of the aggregate demand model is price level, because changes in the price level cause the demand for goods and services to change. The price adjustment model is useful in explaining how the price level adjusts whenever the aggregate demand model is out of equilibrium--not operating at potential GDP. The degree to which the aggregate demand model is out of equilibrium creates the pressure for inflation (or deflation) to help bring the economy back into equilibrium. Finally, what people expect regarding inflation plays a role in inflation as well, so the price adjustment model is expanded to incorporate inflationary expectations. In the sections that follow the aggregate demand model and price adjustment model are examined. Then these two models are be used to further explain the Phillips curve from Chapter 1.

2.2 The Aggregate Demand Curve

To begin analysis, the aggregate demand curve sets forth "all values of the price level and GDP that keep both the economy's money and commodity markets in equilibrium" (Casler p.124). The aggregate demand curve is, in turn, derived from the IS-LM model. The aggregate demand model uses the intersections of the LM and IS curves—all points at which the money and

commodity markets are both in equilibrium—as its data points to create the aggregate demand curve.

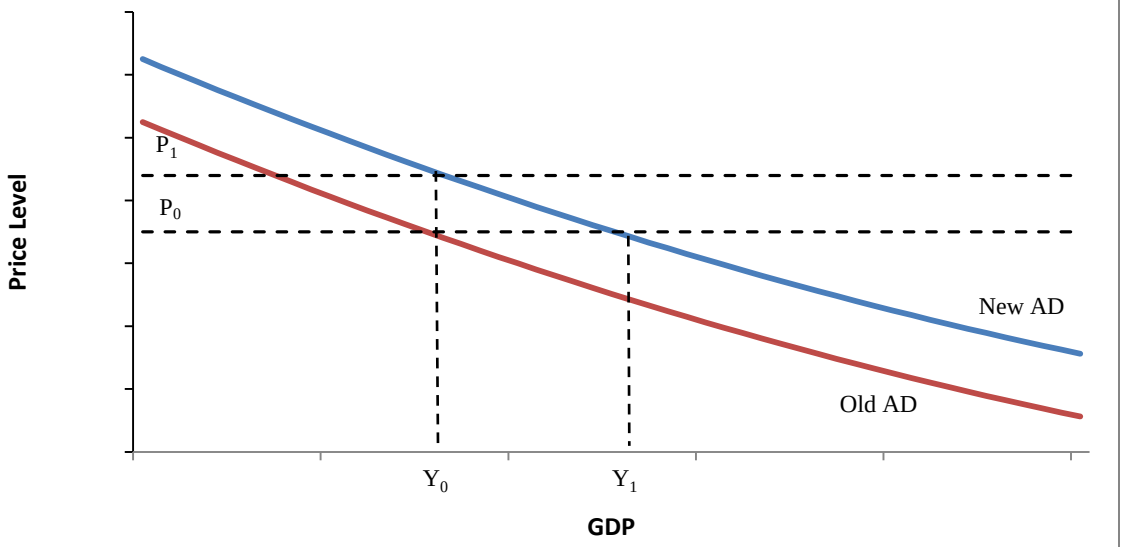
Figure 2.1 displays a basic aggregate demand model, in which the price level is held constant at P_0. It shows the aggregate demand as a downward sloping function that charts the price level vs. GDP. Because it is downward sloping, when the price level is high, demand as measured by GDP is low and vice versa. Specifically, increases in the price level reduce the real money supply which raises the real interest rate, causing investment and the net exports to fall, which lowers GDP through the multiplier. Initially the economy is in equilibrium with GDP=Y_0 and P=P_0. Given a rise in productivity, potential GDP rises as seen in the shift of the vertical line to Y_1 . Since potential GDP rises, the price level falls along the aggregate demand curve until P=P_0 at Y_1.

As seen in the right hand diagram in Figure 2.1, the aggregate demand can also shift outward or inward, which causes a change in equilibrium GDP for any given price level. A shift outward or to the right of the aggregate demand curve can arise from an increase in the nominal money supply, an increase in government spending, a reduction in taxes, a rise in consumer confidence, and a rise in consumer wealth. A decline in the price of capital can also raise investment, as can increases in investor confidence. A shift inward or to the left of the aggregate demand curve occurs when these exogenous variables move in the opposite direction. When aggregate demand shifts out and leads to a level of GDP that is above potential, there is upward pressure on the price level or inflation.

Another aspect of price adjustment based on aggregate demand occurs from changes in the price level by virtue of a price or supply shock. The best example of a supply shock is the oil crisis in the mid-1970s. The supply of oil was constrained by the Gulf suppliers and prices rose

rapidly. And, because oil is such an important commodity, this increase impacted the economy as a whole. Effectively the price line moves upward along the new curve and a new equilibrium is reached at a lower level of output. Indeed, the 1970s introduced the new concept of "stagflation" and "cost-push" inflation, where, despite an economy operating below its potential with high unemployment, there was high inflation. Cost push inflation is caused when price levels are increased due to increases in wages, rents, profits, and interest (Casler p.164).

Figure 2.1: Aggregate Demand Model



Hall, Robert E. and John B. Taylor. *Macroeconomics, Third Edition.* New York: W.W. Norton & Company, 1991.

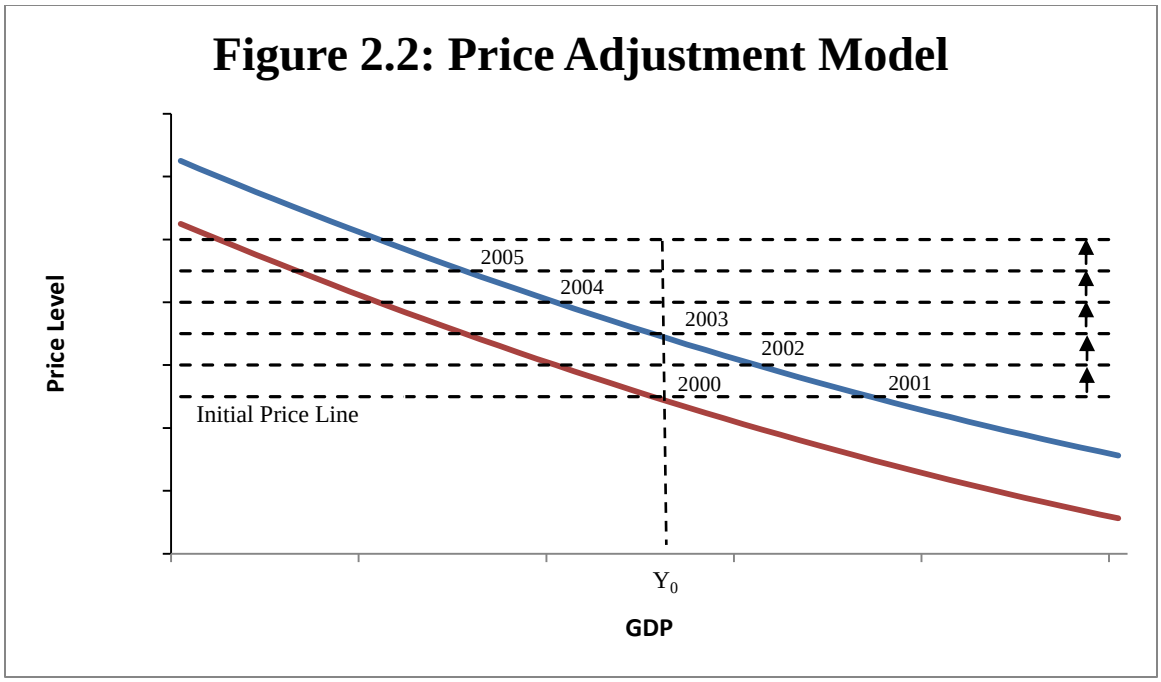
2.3 Price Adjustment Model

The price adjustment model sets forth the sequence of price changes and corresponding changes in GDP that occur whenever the aggregate demand model of the economy is not in long run equilibrium. It is not in long run equilibrium whenever the aggregate demand curve at its intersection with the price line is below or above potential GDP, essentially the GDP that occurs with full employment (Hall p.188). The predetermined price level reflects the overall price level

facing participants in the economy and, at this level, all participants are price takers, which is why the price level is said to be predetermined. While firms can change factors such as their individual prices to try to achieve optimality, these changes take time to take effect in the aggregate, often several periods (or even years), so that the model is considered always in flux, or "dynamic"(Hall p.188).

Figure 2.2 shows how the price adjustment model works following the shift of the aggregate demand to the right, out of equilibrium, with output moving above potential. If aggregate demand shifts out due to, for example, an increase in government spending, GDP exceeds potential GDP, and there is excess demand at the initial, predetermined price level. This creates pressure on capacity and employment and, over time, prices and wages increase correspondingly. Eventually, these factors cause a rise in the price level which lowers demand along the aggregate demand curve. As long as GDP exceeds its potential sustainable level, the pressure on prices will continue and won't stop until GDP again equals potential GDP. Similarly, if the demand model shifts inward, or left, GDP is lower than its potential triggering a series of price level reductions to stimulate growth and bring the economy back to equilibrium (Hall p.194).

In Figure 2.2 , the economy is initially in equilibrium at the potential level of GDP, Y^*. Suppose the aggregate demand curve shifts to the right due to an increase in the money supply. This shift from 2000 to the right to 2001 causes a short run rise in output. Over the course of the following years the GDP moves back to the left and the price level increases in an attempt to get back to Y^*. The price adjustment model reaches equilibrium in 2004 but then continues moving left in 2005.



Hall, Robert E. and John B. Taylor. *Macroeconomics, Third Edition.* New York: W.W. Norton & Company, 1991.

Based on this analysis, it is expected that inflation will occur given a change in any shift factor for aggregate demand that pushes GDP above its potential. The pressure on price adjustment is determined by the amount by which the economy is out of equilibrium (Hall p.188). Economists believe that the inflation rate, π, is a function of the pressure on the market as measured by the percentage of the GDP gap, or the percentage that GDP is above or below the potential GDP. The variable Y_t is the GDP level from the previous period. The variable Y_p is the potential GDP. These two variables are combined in the formula as $\frac{Y_t - Y_p}{Y_p}$ to create the percentage GDP gap. Inflation is assumed to be a simple multiple of the GDP gap.

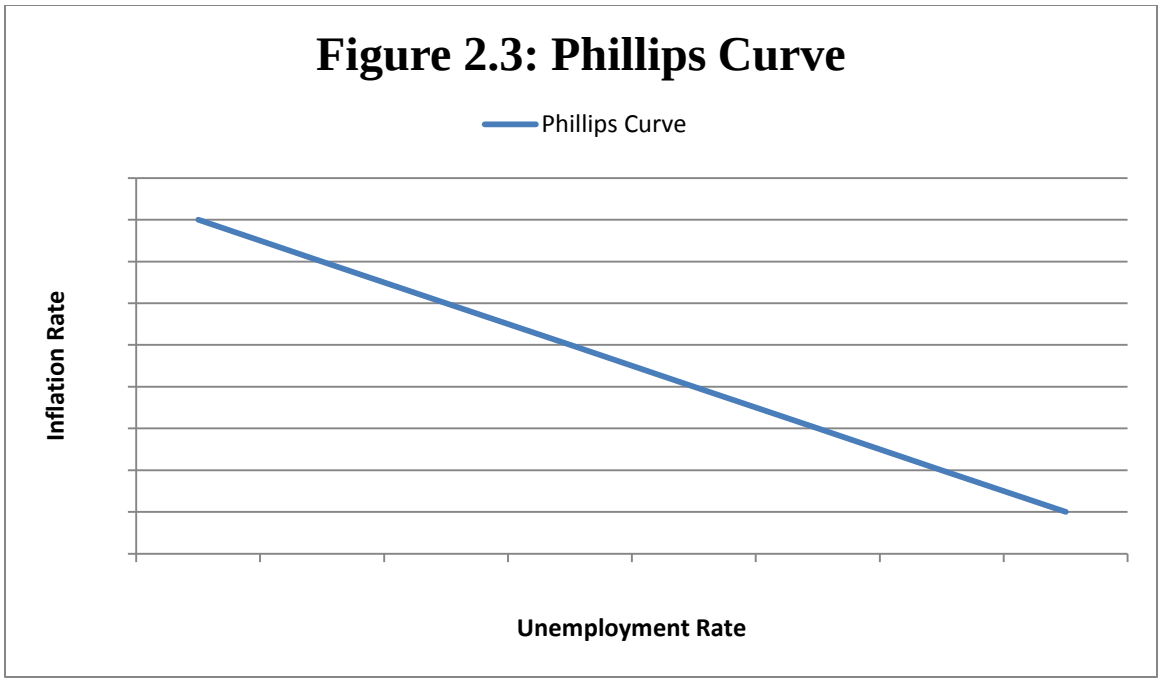
$$\pi = f\ \frac{Y_t - Y_p}{Y_p}$$ (Hall p.188)

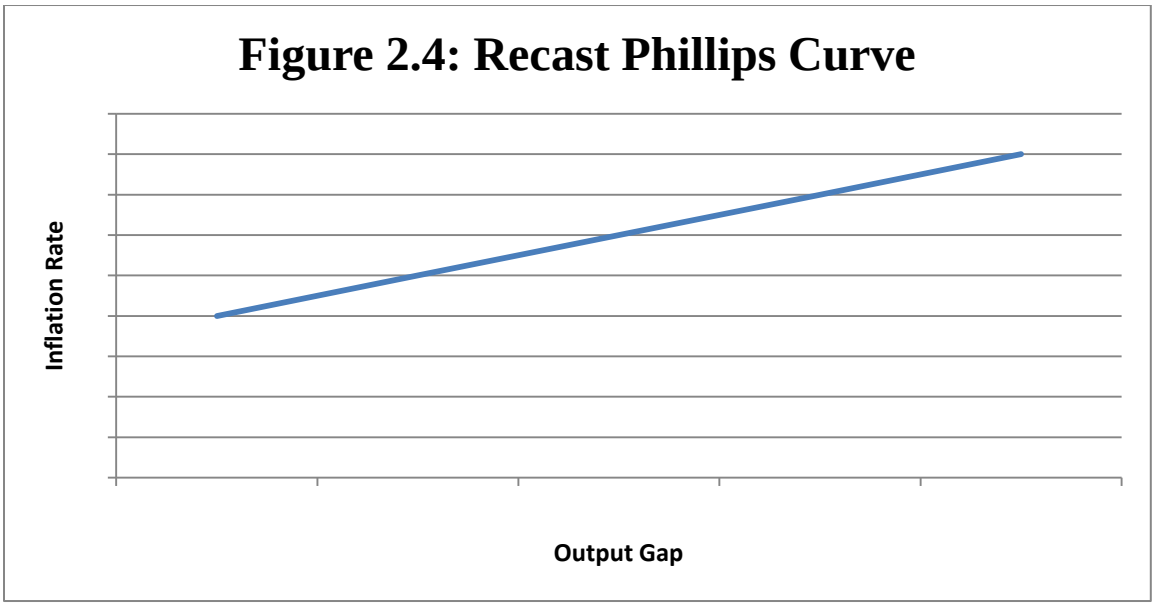
In this equation, f is defined as the sensitivity of inflation to the GDP gap. With a simple linear function, when f is large this means that inflation occurs quickly in response to a given positive

GDP gap and the economy quickly moves back to equilibrium. When f is small, for a given difference between the potential output and actual output the rate of inflation is relatively small and the economy takes longer to recover. The greater the percentage gap, the greater the pressure on prices to help close the gap and bring the economy back into equilibrium.

2.4 Linking the Phillips Curve to the Aggregate Demand and Price Adjustment Models

In Chapter 1 of this study the Phillips curve was examined and the relationship was used to show the inflation and unemployment rate relationship. The Phillips curve asserts an inverse relationship between the inflation rate and the unemployment rate. That is, high unemployment will be accompanied by low inflation (downward pressure on prices) while low unemployment will be accompanied by high inflation (upward pressure on prices). Figure 2.3 displays this basic relationship. In this chapter, we have seen how the price level is inversely related to the GDP gap. When the economy is above its potential, unemployment is low and there is upward pressure on prices, and when the economy is below its potential, unemployment is high and there is downward pressure on prices. Therefore, we can recast the basic Phillips curve to assert the inverse relationship between the inflation rate and the output gap. Figure 2.4 shows this relationship. As seen in the figure, inflation is on the vertical axis with the output gap as the horizontal axis, with the Phillips curve shown. When the output gap is positive, i.e., when the economy is above its potential, inflation will rise. When the economy is below its potential, inflation should fall. The slope of the curve determines the strength of the pressure between the output gap and inflation. With a steeper slope, even small changes in the output gap lead to large movements in inflation.





Hall, Robert E. and John B. Taylor. *Macroeconomics, Third Edition.* New York: W.W. Norton & Company, 1991.

2.5 Accounting for Inflationary Momentum and Expectations

Finally, as Milton Friedman and Edmund Phelps showed in their 1967 work, there is a component of inflation based on the expectations of inflation. Expected inflation is an important variable to examine when concentrating on inflation. Expected inflation is often determined by

examining past inflation. Another approach to estimating where the economy will be in the future is a theory used by economists called rational expectations. Rational expectations use collected information to come up with future estimates that have credibility since they are based on what has been learned from the past and what information is currently known . With rational expectations, economists use previous years' inflation to create trends which help to estimate where the inflation rate will be in the future. Expected inflation can also be greatly altered by what economists believe the Federal Reserve will do to the money supply in an effort to alter inflation. If economic agents believe the Federal Reserve will step in to lower the money supply and tighten credit, then the expected inflation will be lower; if they believe the Federal Reserve will step in to increase the money supply, inflationary expectations rise. We therefore can add an "expectations" component to the recast Phillips curve above (Hall p. 191).

$$\pi = .6\pi_{-1} + f\frac{Y_{-1}+Y^*}{Y^*} \quad \text{(Hall p.191)}$$

The terms in this equation are similar to the terms in the previous inflation equation except that this equation has the addition of $.6\pi_{-1}$. This new term is the expected inflation based on last year's inflation data. Firms use a percentage of last year's inflation, in this case 60% of last year's rate, as the expected inflation rate. This equation is useful because periods of high inflation do not last and inflation will eventually drop back down, so this equation allows economic agents to take this into account. This equation states that inflation is calculated not only by using the percentage GDP gap, but also by the expectation of inflation based on previous year.

2.6 Conclusion

The aggregate demand curve and price adjustment model are useful in examining the causes of inflation in the economy and the adjustment process that results after inflation. Using

the aggregate demand model we can examine data and see when the economy is out of equilibrium and what factors caused demand to shift. The price adjustment model is used when the economy is out of equilibrium and it helps explain the dynamic adjustment process—over time—that inflation or changes in the price levels go through, including how inflationary expectations influence these changes.

Based on the theoretical considerations presented in this chapter, upward pressure on the price level, inflation, is expected to occur given the following key demand side causes: increased government spending, reduced taxes, increased consumer wealth, and exposing monetary policy. On the supply side, inflation is caused by price shocks, such as a rise in the price of oil. Finally, inflationary expectations are important as price adjustments can take a long time to work through the economy, so expectations can influence how companies' price their products and negotiate longer term contracts, thereby building in a level of inflation.

Chapter 3

Regression Analysis

3.1 Introduction to Regression

The previous two chapters examined inflationary models and the relationships among the variables that make up these models. The purpose of this chapter is to use regression analysis to examine the different variables as predictors of inflation. A regression model is a statistical approach used to estimate the relationship between a dependent variable and one or more independent variables. Consistent with the first two chapters, we specify inflation as the dependent variable. Regression models are useful because they allow the dependent variable to be predicted and therefore help to explain inflationary changes that have occurred in previous business cycles. In the sections that follow, a regression model is established and all the variables included in the model are explained. These results help determine which variables are most responsible for inflation and serves as a guide to creating policies to fight inflation. Also the results of the model are presented and examined to determine significance.

3.2 The Regression Model Established

To evaluate the causes of inflation and their actual impacts, a variety of variables are used for the regression model. The GDP deflator is used as the inflation variable in the regression since it is a better determinant of inflation in the US economy. The CPI also shows inflation but does so with a market basket that includes foreign goods. Eight independent variables were used as well as four dummy variables. Based on the theory of the determinates of inflation, the independent variables include the unemployment rate, the growth rate of real energy prices, real wage compensation growth, the federal deficit share, real productivity growth, real Dow Jones growth, the real federal funds rate, and a GDP deflator lag variable.

The Phillips curve relationship discussed in Chapters 1 and 2 implies that the unemployment rate should be inversely related to inflation. The growth rate of real energy prices should be directly related to inflation, and will be interesting to analyze during the oil shocks of the 1970s. Real wage compensation growth could be important as cost-push inflation, which occurs when the prices of important inputs in the economy increase rapidly; hence, high real compensation growth should raise inflationary pressure. The federal deficit share is the ratio of the real federal deficit divided by nominal GDP. As noted in Chapter 2, an increase in government spending shifts out aggregate demand and leads to inflation. The deficit share reflects changes in the deficit but offsets the problem of using the real federal deficit growth rate, since this variable has percentage changes that are so large and volatile that it can skew the regression results. As the deficit share increases—reflecting increased government spending—inflation pressures should rise, unless the rise in the deficit is caused by a recession. Productivity growth is used to capture the effects of technological changes; as productivity increases, inflationary pressures should be lower.

The real grow in the Dow Jones was used to capture the effects of consumer wealth. We expect that as the Dow Jones and consumer wealth rises, inflation should increase. The real Federal Funds rate reflects the Fed's policy for controlling the money supply. As Paul Volcker, the Fed Chairman from 1979 to 1987, the money supply is "at the root cause of inflation" (pbs.org). Hence, we would expect that periods of low Federal Funds rate, when the Fed is being accommodative, to correspond to increasing inflation, while periods of high Federal Funds rate, with the Fed restraining the economy, to lead to declining inflation. This prediction is reversed if the low rates reflect policy to fight recessions.

In addition to the dependent and independent variables, dummy variables are used. Dummy variables are used in the regression analysis in an attempt to account for specific "category" variables, such as recessions or boom periods. Dummy variables are variables that only take on two values, 0 and 1; if the outcome is "in" the category, 1 is assigned; if the outcome is "out" of the category, a zero is assigned. If the dummy variable proves statistically significant in the regression model, it means that the "category" has a significant relationship with the dependent variable. In our model, two dummy variables are used to account for the effects of recessions: one for supply shock induced recessions and one for demand shock induced recessions: a 1 indicates periods of recession while a 0 indicates periods of growth.

The third dummy variable is a structural dummy that indicates the Great Moderation – a period of relative economic stability that occurred from 1984-2006: these years are indicated with a 1 while all other years are 0. The Great Moderation is an important factor to examine since this absence of volatility in the economy allowed significant growth to occur without high rates of inflation. Increased investment rates resulted in improved standard of living and also allowed companies to expand and grow. Economists have examined the causes behind the Great Moderation, they believe improved policy has played a part in the moderation but the deregulation of the financial markets is what many economists believe to be the main cause. The deregulation allowed people the freedom to make decisions and also gave people more tools to allow them to spend more due to their increased income. This allows the economy to settle into a cycle of moderation, but as we know now, it was only temporary (Baker, 2007). The fourth dummy variable is a hyperinflation dummy that is used to separate out periods of high inflation, in this case inflation over 5%: the period from 1969-1970, 1973-1975, 1977-1981, and also 1990.

The data for variables of the model were split into smaller groups based on specific time periods. Period 1 includes the years 1965-1982, Period 2 includes the years 1983-2000, and Period 3 includes the years 2001-2009. These different periods help structure the regressions to determine whether the regression relationships change depending on the unique historical characteristics of these periods. Period 1 starts with the Vietnam War era and extends through the time of the Yom Kippur war, the fall of the Shah of Iran, and the ensuing oil shocks. Period 1 also includes the period of cost push inflation that occurred in the middle and end of the 1970s. Cost push inflation occurs when price levels increase due to changes in the economy such as increased wages, rents, profits, and interest (Casler p. 164). Cost push inflation caused by rising oil prices in spite of a recession occurred until the economy started to recover around 1982. Period 2 includes most of the 1980s and 1990s and corresponds largely with the period known as the "Great Moderation," when the economy was generally stable. The year 1983 shows a sharp decline in inflation and the start of a long period of low inflation. This low inflation continued into the 1990s, which was a period of strong economic growth and technological expansion. The last period, Period 3, includes the 9-11 attack on the World Trade Center, fighting the Iraq and Afghanistan wars, and ended with the most recent recession.

The fundamental equation for the regression appears as

$$C = a + b_1U + b_2E + b_3W + b_4G + b_5X + b_6D + b_7F + b_8Y + b_9H + b_{10}S + b_{11}I + b_{12}J.$$

C is the dependent variable, the GDP deflator; U stands for the unemployment rate; E stands for the growth rate of real energy prices;; W is the real wage compensation growth; G stands for the Federal deficit share; X is the productivity growth; D is the real growth in the Dow Jones; F is the real federal funds rate; and Y is the GDP deflator lag variable,. The variable H is the

hyperinflation dummy variable; I is the recession dummy for supply recessions; J is the recession dummy for demand recessions; and S is the structural dummy variable.

3.3 Regression Results

Inflation: Unemployment and the Phillips Curve

The results of the regressions show the estimated coefficient measures of significance, i.e., whether the independent variables actually explain the dependent variable. Analyzing the independent variables and their relationships to the dependent variable, we check to see if the movements are in the expected directions. Starting with unemployment, when the unemployment rate is decreasing, it increases inflationary pressures. The Phillips curve theory states that there is an inverse relationship between inflation and unemployment. Low unemployment places upward pressure on wages and therefore costs, so as unemployment rises, inflation declines. These expected results are seen by the negative value of the coefficient for unemployment from the regression, regardless of time period. Specifically, a one percentage point rise in the unemployment rate in Period 1 is expected to cause the inflation rate to fall by 0.173 percentage points. For Periods 2 and 3, the coefficient values are -0.369 and -0.255. Therefore, rising unemployment has its strongest effect in reducing inflation in Period 2, during the Great Moderation.

Inflation: Cost Push Based Factors

Growth in real energy prices should increase inflationary pressure. Energy prices greatly affect the whole economy, since with increased energy prices, production and transportation cost increase. With these costs increasing, the cost per unit increases, causing prices throughout the economy to rise. If the growth in the real energy price was decreasing, production and

transportation costs would decrease which would decrease, cost per unit and relieve inflationary pressure. The positive values of the slope coefficients for the growth in energy prices from regression results for all periods confirm that as inflation increases the growth of real energy prices does as well. So, a one percentage point rise in the real energy price in Period 1 is expected to cause the inflation rate to increase by 0.109 percentage points. The coefficient values for Periods 2 and 3 are 0.047 and 0.508. These coefficients are almost half of the coefficient values from Period 1, since Period 1 occurred during the oil shocks of the 1970's.

When examining real wage compensation growth, it relates to increased personal wealth and purchasing power. With real wage compensation growth increasing, we expect inflation to increase. This direct relationship is related to consumer wealth and purchasing power, which as they increase, increases the amount of spending in the economy, which increases inflationary pressure. An increase in wages can also lead to increases in cost, which can cause inflation. The positive value of the slope coefficient real wage compensation coefficient confirms this relationship. The model shows that a one percentage point rise in the real wage compensation growth is expected to cause a 0.014 increase in inflation.

When productivity growth is increasing, due to improved technology, labor costs per unit decline, which reduces inflationary pressure. Another example occurs when the economy approaches or moves past full employment, we know productivity declines (marginal units of production cost more based on the law of diminishing returns) and inflationary pressure increases. So we would expect productivity to be inversely related to inflation. The model creates a coefficient close to zero that happens to be negative, supporting the inverse relationship, although not strongly. Specifically, a one percentage point rise in the productivity growth is expected to casus the inflation rate to decrease by 0.013 percentage points.

Inflation: Fiscal Policy

When deficit share of the GDP is increasing it is important to understand the cause of such increase. If the increase in the deficit share is due to increased government spending, while the economy is at potential GDP it is expected to cause inflationary pressure. If, however, the government spending is increased in an effort to stimulate a poor economy, the inflationary pressure will not be present. The regression model suggests that the latter correlation is stronger, as the coefficients in all periods are negative, that is, that increased deficit share of GDP corresponds to reduced inflationary pressure. The model shows a one percentage point rise in the deficit share in Period 1 is expected to cause the inflation rate to fall by 0.167 percentage points. For Periods 2 and 3 the values of the coefficients are -0.296 and -0.064. Therefore the deficit share had the strongest effect during Period 2, which is most likely a delayed effect from the oil shocks in Period 1. Period 3 shows a significant decrease due to the fact that the economy was improving and a government spending decreased.

Inflation: Monetary Policy

The real federal funds rate is a tool of the Federal Reserve to manage inflation. The Fed increases interest rates to slow an economy in order to help decrease inflation. Therefore we would expect to see a negative correlation between the real federal funds rate and inflation. However we may have a problem with lag effects, since the Fed tends to increase interest rates during periods of high inflation and lower interest rates in periods of recession and low inflation. It is not until the increase interest rates have affected the economy that inflation begins to fall. Hence, from a theoretical perspective we could see a positive correlation in the data. The model yields both negative and positive coefficients for the real Federal Funds rate. A one percentage

point rise in the real federal funds rate in Period 1 is expected to cause the inflation rate to fall by 0.051 percentage point. For Periods 2 and 3 the coefficient values are 0.147 and 0.112. Therefore for these periods an increase in the real federal funds rate results in an increase in inflation. The real federal funds rate coefficients are negative for Period 1, but positive for Periods 2 and 3 because, with the lag effect, the Fed's efforts were not felt immediately.

Inflation: Wealth Effects

Real Dow Jones growth is the growth in the Dow Jones industrial average and relates to the stock market. The Dow Jones growth measures consumer wealth, since, as it increases, purchasing power increase. With the Dow Jones growth increasing, we would expect inflation to increase or decrease. This decrease is expected because, as consumer wealth and purchasing power increase, the strength of economy increases. A strong economy is not as affected by changes in inflation, so inflation may not change. However, increased wealth could be inflationary if the economy is operating above potential. Real Dow growth is based on expected future profits, and this is expected to rise when the future looks good. This was definitely the case in Period 2, with the strong economy and the Great Moderation occurring in this period the future looked as though it would be stable. A one percentage point rise in the real Dow Jones growth in Period 1 is expected to cause the inflation rate to fall by 0.008 percentage points. For Periods 2 and 3 the coefficient values are -0.012 and -0.017. These increasingly negative values follow the expectations of a decrease in inflation since consumer wealth and purchasing power has been increasing in these periods.

Inflation: Dummy and Lag Variables

The hyperinflation dummy variable was used to separate out periods of inflation over 5%. Since it is used to separate out periods high inflation, it is highly correlated to inflation. Specifically, a hyperinflation dummy is expected to cause the inflation rate to increase by 1.723 percentage points, regardless of the levels of the other explanatory variables.

The supply shock recession dummy variable was used to separate out recessions caused by supply shocks. Since prices increase during such periods of supply shock, we would expect the supply shock recession dummy to be correlated to inflation. The model shows that during supply shocks inflation is expected to increase by 0.687 percentage points.

The demand shock recession dummy variable is used to separate out periods of demand shocks. Demand decreases during periods since the value of money has decreased. We expect the demand recession dummy and inflation to be inversely correlated. Specifically, during demand based recessions inflation is expected to fall by 0.464 percentage points. This follows theory since as inflation increases, demand decreases.

The structural dummy variable was used to separate out the Great Moderation, which was a period of economic stability. Since periods of inflation are not periods of economic stability we expect an inverse relationship. Specifically, during the Great Moderation the structural dummy is expected to cause inflation to fall by 0.41 percentage points.

Finally, inflationary expectations which are neither supply or demand factors affect inflation. Price adjustments can take a long time to affect the economy, so inflationary expectations can affect how companies price their product and how they negotiate long term contracts. The GDP deflator lag variable was used to show the effects of inflationary

expectations. Inflationary expectations occur when inflation is expected to go up and people react in a way, causes inflation to go up. Looking at the model, a one percentage point rise in the GDP deflator lag variable is expected to cause the inflation rate to rise by 0.385 percentage points.

Table 3.1 Regression Results

Source	SS	df	MS	Number of obs =	44
				F(22, 21) =	29.16
Model	226.629623	22	10.3013465	Prob > F =	0.0000
Residual	7.4176513	21	.353221491	R-squared =	0.9683
				Adj R-squared =	0.9351
Total	234.047275	43	5.44295988	Root MSE =	.59432

gdpdef	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdpdef1	.385587	.1768436	2.18	0.041	.0178207	.7533533
produc	-.0135273	.0878984	-0.15	0.879	-.1963221	.1692674
defs1	-.1677861	.2491563	-0.67	0.508	-.685935	.3503629
defs2	-.2963469	.121364	-2.44	0.024	-.5487371	-.0439567
defs3	-.0642058	.1600371	-0.40	0.692	-.3970211	.2686096
unemp1	-.1732746	.2352953	-0.74	0.470	-.6625979	.3160488
unemp2	-.3688246	.168043	-2.19	0.040	-.7182891	-.0193602
unemp3	-.2558698	.1867741	-1.37	0.185	-.6442878	.1325483
rwcompgro	.0147126	.0122822	1.20	0.244	-.0108296	.0402548
epgro1	.1090417	.0423869	2.57	0.018	.0208934	.1971901
epgro2	.0473195	.0387645	1.22	0.236	-.0332957	.1279346
epgro3	.0508896	.0320695	1.59	0.127	-.0158025	.1175818
rffr1	-.0511214	.082923	-0.62	0.544	-.2235692	.1213264
rffr2	.1476648	.1060907	1.39	0.179	-.0729629	.3682924
rffr3	.1125377	.2169897	0.52	0.609	-.3387171	.5637924
rdowgro1	-.0080586	.0109167	-0.74	0.469	-.030761	.0146439
rdowgro2	-.0123632	.0094825	-1.30	0.206	-.0320831	.0073567
rdowgro3	-.0179527	.0147955	-1.21	0.238	-.0487216	.0128162
hypinfdum	1.723915	.5324624	3.24	0.004	.6165991	2.831231
dumrecs	.6875612	.4860675	1.41	0.172	-.3232715	1.698394
dumrecd	-.4646665	.4376284	-1.06	0.300	-1.374764	.4454315
strucdum	-.4109358	.5056728	-0.81	0.426	-1.46254	.6406684
_cons	3.101099	.8688498	3.57	0.002	1.294227	4.907971

3.4 T-tests and Measures of Fit

To determine the validity of the regression an important measure to examine in the R-squared value. The R^2 measurement lies between 0 and 1, and the closer the result is to 1 the more effectively the regression explains the dependent variable. This is actually a percentage, so the closer to 100% the better the regression fit is. (Carlson p. 441) The R-squared value for the regression was 96.8%, which is a high value and show that this is an effective regression. The measure R^2 is the coefficient of determination for a regression equation.

In regression models, "A good rule of thumb is to conclude that a relationship exists if the absolute value of the t-statistic is greater than 2" (Carlson p. 448). Then when examining the different variables and their t-statistics, we see that only the GDP deflator lag variable, the deficit share from period 2, unemployment from period 2, real energy price growth from period 1, and the hyperinflation dummy variable were significant. This significance is determined by the value of the t-statistic with absolute values greater than 2.

The formed t-test involves the use of specific hypotheses. The null hypothesis states that there is no relation between the dependent and independent variables so H_0: β_i=0. The alternative hypothesis is that there is a relationship between the dependent variable and the independent variable, shown as H_1: $\beta_i > 0$ or < 0 or$\neq 0$, depending on theoretical epectations. The t-statistic is the ratio of $\frac{b_i}{S_{bi}}$. In this equation, b_i is the estimator of the population, and S_{bi} is the standard deviation of b_i. This means it is the difference between the hypothesized or expected value of the slope coefficient regression model and the actual results. So depending on the theoretical predictors regarding the sign of a coefficient, we will look for independent variables in our regression model that yield a t-statistic greater than 2 in absolute value.

3.5 Possible Flaws with Regression

When running a regression there are a number of problems that can occur that could cause the results to be slightly off. These problems include multicollinearity, autocorrelation and also other biases that the test can't account for. Multicollinearity occurs when independent variables in the regression affect each other and not just the dependent variable. Table 3.2 shows the collinearity between all of the variables used in the regression. There is multicollinearity if the coefficient is close to 1. If we consider all coefficients over .85 to be close to 1, then three variable relationships display multicollinearity. The positive relationship between the GDP

deflator variable and the GDP deflator lag variable shows multicollinearity with a coefficient of 0.8714. This result is not unexpected since a lag variable should relate strongly to the variable it is lagging. The negative relationship between unemployment from Period 1 and the deficit share from Period 1 has a coefficient of -0.8963. During this period there was a lot going on in the economy and unemployment was high. The relationship shows that the government increased spending to try to offset the low unemployment which explains the high coefficient. The last variable relationship that showed multicollinearity is the relationship between the real Dow Jones growth in Period 3 and the real wage compensation growth. The coefficient for the relationship was 0.9957, which is extremely close to 1. Both of these variables relate to personal wealth and clearly in Period 3 the real wage compensation growth contributed to the growth in the real Dow Jones from that period.

When examining autocorrelation the Durbin Watson statistic is used. Autocorrelation is the "correlations between first order errors through time" relating to the relationship between variables over different times (Carlson p.597). Autocorrelation can be used to isolate patterns and can help show business cycles. The Durbin Watson statistic is between 0 and 4 with 2 meaning no autocorrelation. The Durbin Watson statistic from the regression is 2.812. A statistic of 2.812 means that there is only modest autocorrelation.

Table 3.2 Collinearity Table

	gdpdef	gdpdef1	produc	defs1	defs2	defs3	unemp1	unemp2
gdpdef	1.0000							
gdpdef1	0.8714	1.0000						
produc	−0.3916	−0.2640	1.0000					
defs1	−0.7070	−0.8194	0.0766	1.0000				
defs2	0.2002	0.0769	0.0589	−0.3390	1.0000			
defs3	0.2946	0.2350	−0.1822	−0.2058	−0.1868	1.0000		
unemp1	0.8466	0.8480	−0.2081	−0.8963	0.4119	0.2501	1.0000	
unemp2	−0.4245	−0.3190	0.0130	0.4885	−0.8254	0.2691	−0.5935	1.0000
unemp3	−0.3678	−0.3253	0.2282	0.2993	0.2716	−0.8215	−0.3637	−0.3913
rwcompgro	−0.1088	−0.0464	−0.0261	0.0722	0.0635	−0.1949	−0.0987	−0.1080
epgro1	0.5736	0.3416	−0.4432	−0.1618	0.1199	0.0728	0.3011	−0.1728
epgro2	0.1408	0.0386	0.0462	−0.1280	0.5139	−0.0705	0.1555	−0.3485
epgro3	0.0245	−0.0624	−0.1294	0.0827	0.0751	0.1966	−0.1005	−0.1081
rffr1	0.1968	0.3753	−0.0890	−0.3716	0.1358	0.0824	0.3959	−0.1956
rffr2	−0.3533	−0.2700	0.0505	0.4228	−0.6394	0.2329	−0.5137	0.8372
rffr3	0.0457	0.0372	−0.1896	0.0235	0.0213	0.4764	−0.0285	−0.0307
rdowgro1	0.1934	0.4944	0.0594	−0.4910	0.0544	0.0330	0.3599	−0.0784
rdowgro2	−0.1658	−0.0817	0.0570	0.1433	−0.3578	0.0789	−0.1741	0.3220
rdowgro3	−0.1128	−0.0719	−0.0290	0.0923	0.0837	−0.1987	−0.1121	−0.1206
hypinfdum	0.7874	0.5604	−0.3402	−0.3634	0.2196	0.1944	0.6068	−0.3672
dumrecs	0.7111	0.6278	−0.3135	−0.5078	0.2204	0.1338	0.6330	−0.3175
dumrecd	−0.1503	−0.1147	−0.0292	0.2908	0.0152	−0.2841	−0.1903	−0.1427
strucdum	−0.6347	−0.6387	0.0807	0.6397	−0.3953	0.0527	−0.7773	0.6237

	unemp3	rwcomp~o	epgro1	epgro2	epgro3	rffr1	rffr2	rffr3
unemp3	1.0000							
rwcompgro	0.2756	1.0000						
epgro1	−0.1059	−0.0457	1.0000					
epgro2	0.1025	−0.0144	0.0453	1.0000				
epgro3	0.0764	0.3311	−0.0293	0.0283	1.0000			
rffr1	−0.1199	−0.0075	−0.2934	0.0513	−0.0331	1.0000		
rffr2	−0.3387	−0.0804	−0.1496	−0.3924	−0.0936	−0.1693	1.0000	
rffr3	−0.1073	0.3800	−0.0083	0.0080	0.4365	−0.0094	−0.0266	1.0000
rdowgro1	−0.0481	0.0369	−0.1986	0.0205	−0.0133	0.5211	−0.0679	−0.0038
rdowgro2	−0.1148	0.0385	−0.0507	−0.6339	−0.0317	−0.0574	0.4494	−0.0090
rdowgro3	0.2845	0.9957	−0.0326	0.0316	0.3385	−0.0369	−0.1044	0.3859
hypinfdum	−0.2827	−0.1019	0.4857	0.1617	−0.0781	−0.0035	−0.3429	−0.0222
dumrecs	−0.1946	−0.0457	0.4723	0.0832	−0.0538	0.4115	−0.2748	−0.0153
dumrecd	0.3719	0.3181	−0.1841	0.0828	−0.1293	0.0008	−0.1807	0.1690
strucdum	0.0922	−0.1462	−0.2263	−0.1685	0.1892	−0.2562	0.5316	0.0251

	rdowgro1	rdowgro2	rdowgro3	hypinf~m	dumrecs	dumrecd	strucdum
rdowgro1	1.0000						
rdowgro2	−0.0230	1.0000					
rdowgro3	−0.0148	−0.0354	1.0000				
hypinfdum	−0.1822	−0.1517	−0.0871	1.0000			
dumrecs	0.2786	−0.0931	−0.0600	0.5353	1.0000		
dumrecd	−0.1000	−0.0201	0.3208	0.1361	−0.1873	1.0000	
strucdum	−0.1027	0.1987	−0.1493	−0.4991	−0.4159	−0.1394	1.0000

3.6 Conclusion

The purpose of the regression model is to statistically determine significant correlations between the independent variables and the dependent variable, inflation. Significance as measured by a t-statistic greater than 2 offers only a handful of such strong correlations, as the economy is complex particularly over long periods of times, adding much noise to what could otherwise be stronger correlations. The data in this Chapter appears to confirm the insights from

Chapters 1 and 2 by suggesting that unemployment is a significant determinant of the inflation rate as predicted by the Phillips curve. With this additional information, we can see that there are other factors that appear to consistently and positively correlate with inflation across most time periods, most significantly, the GDP deflator lag variable, which captures the effects of inflationary expectations and inflationary inertia, deficit share from period 2, the energy price growth in period 1, and also the hyperinflation dummy variable. While these were the variables that were statistically significant, there were others that were close. Energy price growth in period 3, real Dow Jones growth in periods 2 and 3 and also the recession dummy for supply recessions. While these variables have less significance, they still affect inflation.

Chapter 4

4.1 Review

In Chapter 1 it was established that inflation is an important part of the economy and changes in inflation can alter the whole economy. Times of high inflation have in the past preceded economic recessions and periods of high unemployment. Once the economy is able to recover, unemployment declines and the inflation subsides. Inflation is often caused when the economy is expanding too much or too quickly. At times like these, a recession actually can cause inflation to decrease and bring the economy back to a stable level. The Federal Reserve steps in to help control inflation, which causes recessions to speed up recovery, but the Fed can stimulate the economy when inflation is under control. While the Fed does as much as it can, there are certain things that are out of its control. Specific goods can greatly affect inflation, with oil being most notable. Oil is a commodity that affects everything in the economy and the inflation rate. A good example of how much oil can cause cost push inflation is the oil shocks of the 1970s.

Chapter 2 established theories related to inflation and examined the aggregate demand curve and the price adjustment model. The aggregate demand model can be examined when the economy is in equilibrium and, compared to when it has shifted out of equilibrium, to determine the factors behind the shift. The price adjustment model is used when the economy is out of equilibrium and helps to explain how the economy adjusts over time through a series of changes in the price level. The theoretical models and explanations from Chapter 2 were used to determine the different factors that affect inflation. It was determined that upward pressure on inflation occurs due to both demand and supply side causes. For demand causes, increased government spending, reduced taxes, increased consumer wealth, and decreases in the interest

rate can all stimulate inflation. Supply factors that can effect inflation include broad price shocks, such as the increase in the price of oil. Finally, inflationary expectations which are neither supply or demand factors affect inflation. Price adjustments can take a long time to affect the economy, so inflationary expectations can affect how companies price their product and how they negotiate long term contracts.

Chapter 3 established the regression model and provided the regression results. The regression showed that most of the variables chosen had a theoretically correct relationship with the GDP deflator in determining inflation. The regression appears to confirm the Phillips curve relationship mentioned in Chapters 1 and 2 that unemployment is a significant determinant of the inflation rate. Also the regression model showed that there are many other factors that affect inflation. Even if they only effect inflation in a small amount they are still important to note.

4.2 Inflation Policy Today and Looking Forward

As this paper has shown, inflation is a critical challenge faced by the economy. The Federal Reserve prioritizes policies in an attempt to control inflation. As we have seen, high inflation, which as we established earlier as anything over 5%, creates severe disruptions and can cause chaos in the economy. Looking over the regression results certain variables show a relationship to inflation that either causes inflation or could be used to fight inflation. The GDP deflator lag variable is one of the variables that causes inflation. The GDP deflator lag variable relates to inflationary expectations, which as we saw earlier in the paper can actually cause more severe inflation to occur. Another variable that caused inflation to increase was the energy price growth, especially in Period 1. The increase in the cost of energy affects the entire economy and causes severe inflation. These are two variables that the Fed needs to concentrate on keeping

low and under control. Variables from the regression that were significant and caused inflation to decrease were the unemployment rate and also the structural dummy variable. Looking at the unemployment variables we see that they all cause inflation to decrease, most notably the unemployment rate in Period 2. While the increased unemployment results in decreased inflation this would be a last resort since the result would be putting people out of work. The other variable that showed decreases in the inflation rate was the structural dummy variable. Not surprisingly, periods of stability in the economy are good for inflation as it allows inflation to moderate and decrease.

The Fed normally uses two different methods to influence the inflation rate: first they control the interest rate, and second they control the money supply. In order to control the interest rate, the Federal Reserve uses the federal funds rate. The federal funds rate is the interest rate that banks charge other banks for loans. This helps to maintain the reserve requirement which is how much money banks must have on hand every day. This relates to the other tool the Fed uses which is controlling the money supply. Ways that the Federal Reserve controls the money supply include changes to the reserve ratio, altering the discount rate, or with open market operations. The altering of the reserve ratio changes the amount of money banks are required to have which in turn alters the money supply.

Today the economy is in a recession and inflation remains relatively moderate. While inflation is not currently a main concern of the Fed due to the focus on high unemployment and the current recession, it is still monitored. The Fed is very active in watching inflation due to the unexpected and high social costs that it causes. As we have seen, the economy moves in cycles, so today's calm will someday end and the Fed will be prepared to step in and control inflation.

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