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Financial Institutions and U.S. Economic Growth: Expansionary and Contractionary Effects



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Expansionary and Contractionary Effects

by

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Submitted to The Department of Economics

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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.

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Abstract

The purpose of this study is to examine the effects of the finance industry on the Gross Domestic Product in the United States. The study examines factors that cause fluctuations in GDP growth, including the growth of the financial sector, technological shocks, changes in the size of the capital stock, and demand side shocks that affect GDP over time. These fluctuations are studied through various variables that explain GDP growth, such as the changing output shares of finance, insurance, real estate, rental and leasing (FIRE), services, and manufacturing; mortgage debt; technological change; inventories; labor force participation rates; wealth effects; and investment. There are three important subperiods into which the explanatory variables are broken down and tested: the period before the Great Moderation; the Great Moderation; and the Great Recession era. The study further examines potential causes of the recent increase in economic volatility, with a focus on the instability in the housing market, and especially the financial sector. In addressing the effects of the finance industry on GDP, a regression model is employed to provide empirical evidence of determinants that are significant to economic growth.

The regression model results suggest that the ratio of FIRE share relative to manufacturing share in periods one and three, investment, inventories, and interest rates in the first period, all are statistically significant in determining GDP growth. Conversely, the coefficients for the ratio of FIRE share relative to service share, mortgage debt growth, inflation in the first period, labor force participation rate, interest rates in the second and third periods, and increases in personal wealth in the second and third periods, are statistically insignificant in determining GDP growth. Based on this evidence, the study makes use of the theoretical and empirical findings to address conceivable recommendations on how GDP growth can be best stimulated in the years to come.

Chapter One: The Financial Sector and The Determinants of GDP Growth: An Overview

1.1 Introduction

With the exclusion of recent events, tracing back over the last three decades the economy experienced what was distinctly one of the less volatile periods in American history. The United States relished in long economic expansions throughout these decades, a period better known as the Great Moderation. Very low levels of volatility, economic prosperity, and a more often than not booming economy led many to believe that the Great Moderation was a likely permanent economic state. However, by late 2007 the prosperity and delight had vanished as the United States entered into one of its most trying periods in economic history – the Great Recession era. The financial markets were one significant factor contributing to large shocks, increasing volatility and the rise of macroeconomic variability. Economic tremors began to hit and a financial meltdown threatened the U.S. and the world economy. The instability within financial institutions and the severity of the recession that sprung in 2007 set the stage for this study of the effects of financial institutions on U.S. economic growth. Favorable to our study is the conjecture that structural changes in the economy, improved monetary policy, and smaller economic shocks, may be what caused lower volatility during the Great Moderation. These factors allow us to examine potential causes of the recent increase in economic volatility, with a focus on the instability in the housing market, and especially the financial sector.

The purpose of this study is to examine the effects of the finance industry on the Gross Domestic Product in the United States. Specifically, the study examines the full range of factors that cause fluctuations in GDP growth, including the growth of the financial sector, technological shocks, changes in the size of the capital stock, and demand side shocks that affect GDP over time. These fluctuations are studied through various variables that explain GDP growth, such as

the changing output shares of finance, insurance, real estate, rental and leasing (FIRE), services, and manufacturing; the instability of the housing market as reflected in mortgage debt; technological change; inventories; labor force participation rates; the unemployment rate; wealth effects; and investment. With a focus on all factors that cause shocks to GDP growth, the study pays special attention to the role of the financial services sector over time. Examining changes in GDP and factors that have an adverse affect on the economy, we find that the growth in the share of FIRE generally leads to less growth in the share of GDP, especially relative to manufacturing. Manufacturing growth can be argued to be a better stimulus than FIRE, since manufacturing is a tangible good and FIRE is a financial service. We also examine how the different explanatory variables may be leading, lagging, and pro or counter cyclical indicators of GDP. Lastly, the study analyzes the role these factors played leading into the Great Recession era. The purpose of this analysis is to measure the significance of the impact of changes in each explanatory variable that resulted in the nation's most gripping financial crisis in the postwar period. To provide contextual and comparative meaning to the turmoil experienced by the crisis, we examine the period of U.S. economic history before, during, and after the Great Moderation. Further, in order to understand the theoretical determinants of long run growth in the economy, we examine the production function, which shows how output can be produced from given amounts of labor, capital, and the given state of technology, and how changes in the factors are expected to affect GDP.

1.2 Industry and Innovation: A Historical Perspective

The evolution of the financial sector in the United States, like many other sectors, has experienced variations in its importance relative to economic growth. We engage in a brief historical overview of the finance industry to better comprehend the motive of this study.

Without consideration of the latest recessionary events, there have been two other instances where finance seemed to regress. The first, and by far the largest, is the collapse of banking and the resulting tightening of regulations of the Great Depression. A prevalent regulatory change rising out of industry failure during this era was the implementation of the Glass-Steagall Act of 1933, which prohibited commercial banks from participating in investment banking activities and protected bank depositors from risks associated with security transactions. The second instance where finance regressed, Philippon (2008) argues, is the Savings and Loans crisis of the 1980s and the resulting disintermediation of credit, which we consider in our empirical analysis of this study. Mishkin (2009) further contributes by pointing to legislation that deregulated the banking industry in the early 1980s. Namely, the Depository Institutions Deregulation and Monetary Control Act of 1980 and the Depository Institutions Act of 1982, enabled the Savings and Loans and mutual savings banks to engage in new risky activities. Through this new legislation, institutions could disperse assets among commercial real estate loans, consumer lending, commercial loans and leases, and junk bonds or direct investments. The crisis was inflamed as Savings and Loans managers lacked the required expertise to manage these new lines of business, which further accentuated complications with the rapid growth of new lending (Mishkin, 2009).

As the efficiency of the financial system struggled, demands of the corporate sector and credit constraints continued to rise in the 1980s. Schumpeter (1934) prophetically argued that efficient financial systems promote innovations, which, in turn, lead to faster economic growth. Bernanke (2007) follows the argument by explaining that, although financial innovation creates risks, we should also consider the enormous economic benefits that flow from a healthy and

innovative financial sector. However, the need to enhance risk management has become the primary driving force behind financial innovations.

We must then consider the real effects of financial innovation and deregulation in the banking system and how the financial regulatory regime in the United States affected financial stability and economic performance. Financial innovations reduce risks, reduce costs, and improve on a product or service to better satisfy demand in the financial system. Financial innovation has been argued to have decreased the profitability of traditional lines of business for commercial banks, and further increased competition. Jackson (1987) reports that bankers created new financial products resembling securities, and securities firms innovated with financial products resembling loans and deposits. Mishkin (2009) makes the similar argument regarding banks facing "increased competition for their sources of funds from new financial institutions such as money market mutual funds even as they were losing commercial lending business to the commercial paper market and securitization" (Appendix p. 44). Philippon (2008) explains that much of the growth of the financial sector occurring between 1980 and 2001 is linked to the information technology revolution. It follows that information technology improved system efficiency by creating a larger market, and, as deregulation increased, so did the competition of reaching out to customers with innovative products. The Glass-Steagall Act was subsequently dismantled in 1999 with the passing of the Gramm-Leach-Bliley Act. The Gramm-Leach-Bliley Act, also known as the Financial Services Modernization Act, repealed the restrictions put on banks from offering financial services like financial investments, insurance-related services, and from collaborating with full-service brokerage firms.

Factors to consider as contributors to the instability of financial institutions were innovative new products such as subprime mortgages, credit default swaps, credit derivatives,

hedge funds, collateralized mortgage obligations, and new production processes such as credit scoring and the influence of credit ratings of institutions by credit rating agencies. Market-driven financial innovations, such as securitization, made credit available to more households and firms. Clark acknowledges the "increase in availability of credit [is what] may have allowed households and firms to better smooth out changes in spending over the course of ups and downs in the business cycle" (p. 15). However, these market-driven financial innovations may be to blame for the instability that ascended within financial institutions in recent years, and further added to economic uncertainty.

1.3 Defining Gross Domestic Product

The performance of the economy of the United States is measured by gauging the size of the total dollar value of all final goods and services, produced by labor and property located in the U.S., over a specific period of time. This measure of the health of the economy is better known as gross domestic product, or GDP. Measurement of GDP is performed through an income approach or an expenditure approach. Under the income approach, GDP is computed by adding the total compensation of employees, gross profits for incorporated and non-incorporated firms, and taxes minus any subsidies. The expenditure approach is more common when measuring GDP, and is calculated by totaling consumption, investment, government spending, and net exports. GDP is by far the most followed, discussed, and analyzed indicator that reflects the health of the economy. Economic production and growth, as reflected in GDP, have a large impact on the well being of the economy, as seen in another important measure of the health of the economy, the unemployment rate.

The economy typically experiences low unemployment rates as GDP grows. Figure 1.1 shows the countercyclical relationship between the unemployment rate and real GDP growth. The unemployment rate is typically a lagging indicator of GDP.

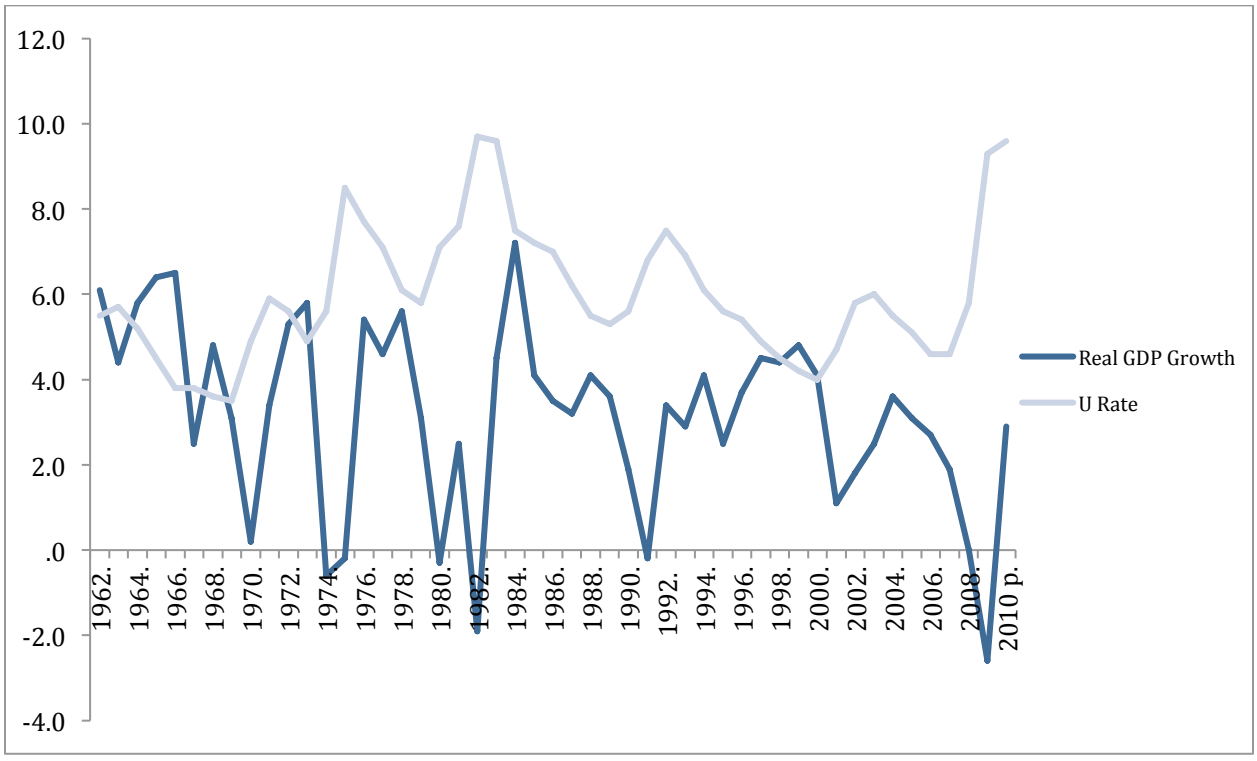


Figure 1.1: Real GDP vs. Unemployment Rate
Source: Economic Report of the President

Observe the rise in the unemployment rate that followed the decline of real GDP growth in 1973. Conversely, the unemployment rate declines following the rise of real GDP growth that began in 1975. Note that businesses demand labor to meet the needs of a growing economy; hence, as GDP grows, the unemployment rate typically falls. However, we exclude the unemployment rate in our regression model with the rationale that, generally, unemployment does not explain GDP – it is GDP that explains unemployment. Further, GDP incorporates and affects many indicators that are coincidently affected as GDP rises or falls.

1.4 The Role of the Financial Sector

As noted in the introduction, this study examines the full range of factors that affect GDP growth over time, with a special focus on the role of the financial sector. In an attempt to quantify the state of the economy, real GDP is the one indicator that speaks volumes when analyzing economic growth, and has the capacity to almost always move markets. In trying to compose a quantitative analysis of the impact the financial sector has on economic growth, we look at the trends of finance, insurance, and real estate; mortgage debt; and the stock market. To begin, the financial services sector includes the main sub-sectors of the banking industry, the insurance industry, and insurance and financial intermediaries. In the United States, the financial services sector is comprised of banking, insurance, securities, commodities, and other financial investments. In 2006, Clark (2009) states the sector employed "approximately 8.363 million workers [with] about 1.825 million in banking; roughly 2.3 million in insurance, and 0.816 million in securities, commodities and other investments, and the balance in real-estate-related activities" (p. 8). Clark further notes the trajectory trend of this growing industry indicates that the financial sector would be employing approximately 9.57 million workers by 2016, increasing employment in that section by 14 percent since 2006.

Figure 1.2 shows the real growth rate of finance, insurance, and real estate (FIRE) as compared to the real GDP growth. FIRE output growth is pro-cyclical in relation and is a leading indicator of economic activity. Observing economic activity for 2005, the real growth rate of FIRE declines approximately one year ahead of real GDP growth. Note the corresponding behavior as FIRE growth reached the trough in 2008 and began to rise ahead of GDP growth. Similar trends can be identified in the postwar period in both booms and busts of the economy. However, overall real FIRE growth experiences faster recoveries during

downturns and decelerates at a slower rate during expansions, i.e., it has historically been relatively recession proof. Additionally, Frame and White (2009) acknowledge the impact finance has on all production activity and consumption activity, as improvements in the financial sector have positive ramifications throughout the economy.

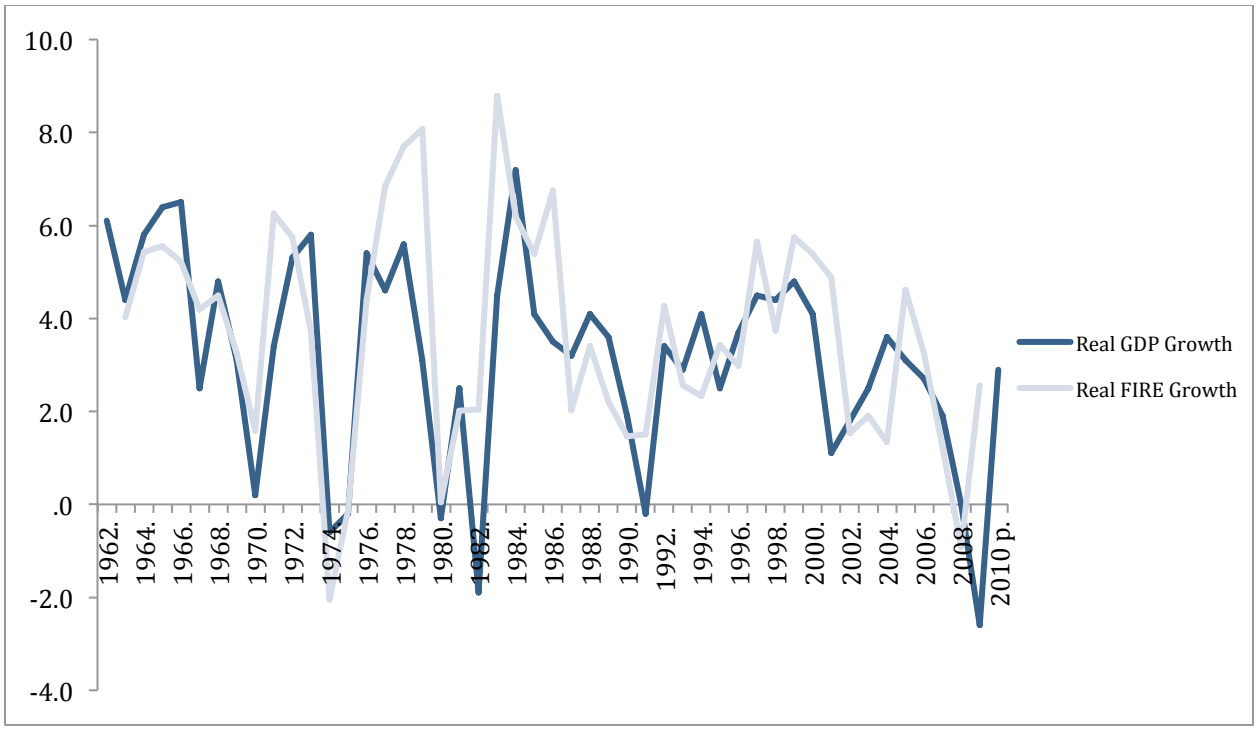


Figure 1.2: Real GDP Growth vs. Real FIRE Growth
Source: Economic Report of the President

Similarly, the real growth of mortgage debt in the United States can be examined as an explanatory variable of the financial sector's impact on GDP. There is a need to examine the implications of mortgage debt for macroeconomic developments, money growth, and financial stability. Financial stability considerations call for the examination of the risk implications of growing mortgage debt levels for both financial institutions and consumers. The relationship between the real growth of mortgage debt and real growth of GDP is subsequently pro-cyclical

in the postwar period, until the years preceding the housing bubble that fueled the recession of 2007 – 2009, as seen in Figure 1.3.

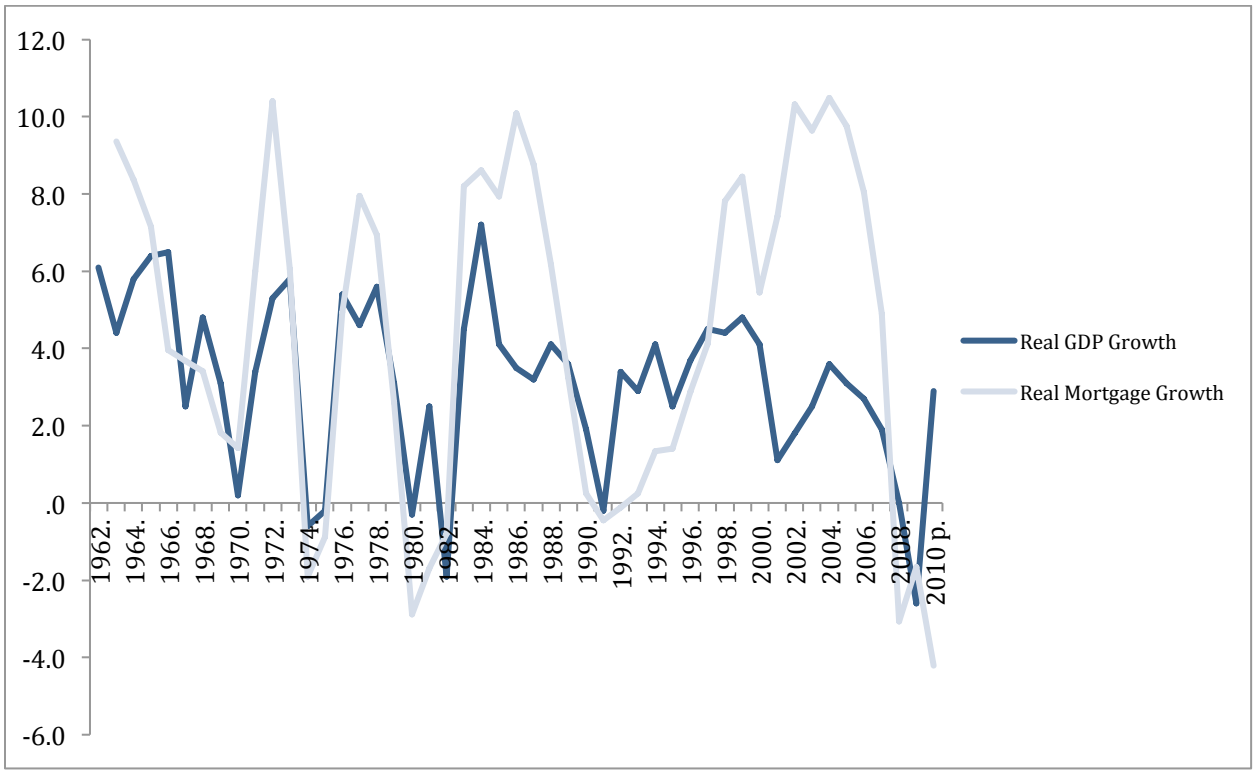


Figure 1.3: Real GDP Growth vs. Real Mortgage Debt Growth
Source: Economic Report of the President

The housing bubble, is explained by Investopedia, as the result of "the combination of very low interest rates and loosening of credit underwriting standards [which brought] borrowers into the market, fueling demand"

As the housing bubble inflated, few regulators took notice. This behavior is demonstrated as the relationship between real mortgage debt growth and real GDP growth became countercyclical between the years 2000 and 2004. Those who did take notice turned a blind eye as the growth of mortgage debt levels for both financial institutions and consumers rapidly approached the bursting point. The belief that home prices had always risen in the past

and would continue to rise in the future validated the rise of mortgage debt. The extraordinary housing boom, thought to be indefinite, rapidly crashed, as demonstrated by the massive decline in real growth of mortgage debt starting in 2004 (Figure 1.3).

GDP again entered into a pro-cyclical relationship with mortgage debt as the demand for homes plummeted and the need for home loans declined. The collapse of the housing market, Clark (2009) explains, "sharply slowed the economy through the direct contributions of residential investment to GDP and spillovers associated with consequences such as rise in unemployment and construction" (p. 18). Clark's findings additionally point out residential investment falling more than 50 percent from the fourth quarter in 2005 to the second quarter in 2009, adding to unemployment rates through job losses in construction by as much as 16 percent over the same period. Equally important, Greenwald and Stiglitz (1993) consider firms responding to shocks by reducing output, labor, and inputs, by also reducing investment, which include buildings and other construction related activities.

Another explanatory variable within the financial industry that reflects economic activity is the stock market. For simplicity, we examine historic trends of the Down Jones Industrial Average in the postwar period as reference to stock market activity. Typically, any changes in GDP, whether up or down, have a significant effect on the stock market. During both economic booms and busts, the stock market is volatile in behavior as it is highly sensitive to economic changes. Figure 1.4 compares the real GDP growth to the real growth of the Dow Jones and indicates a less than typical, but yet, pro-cyclical relation.

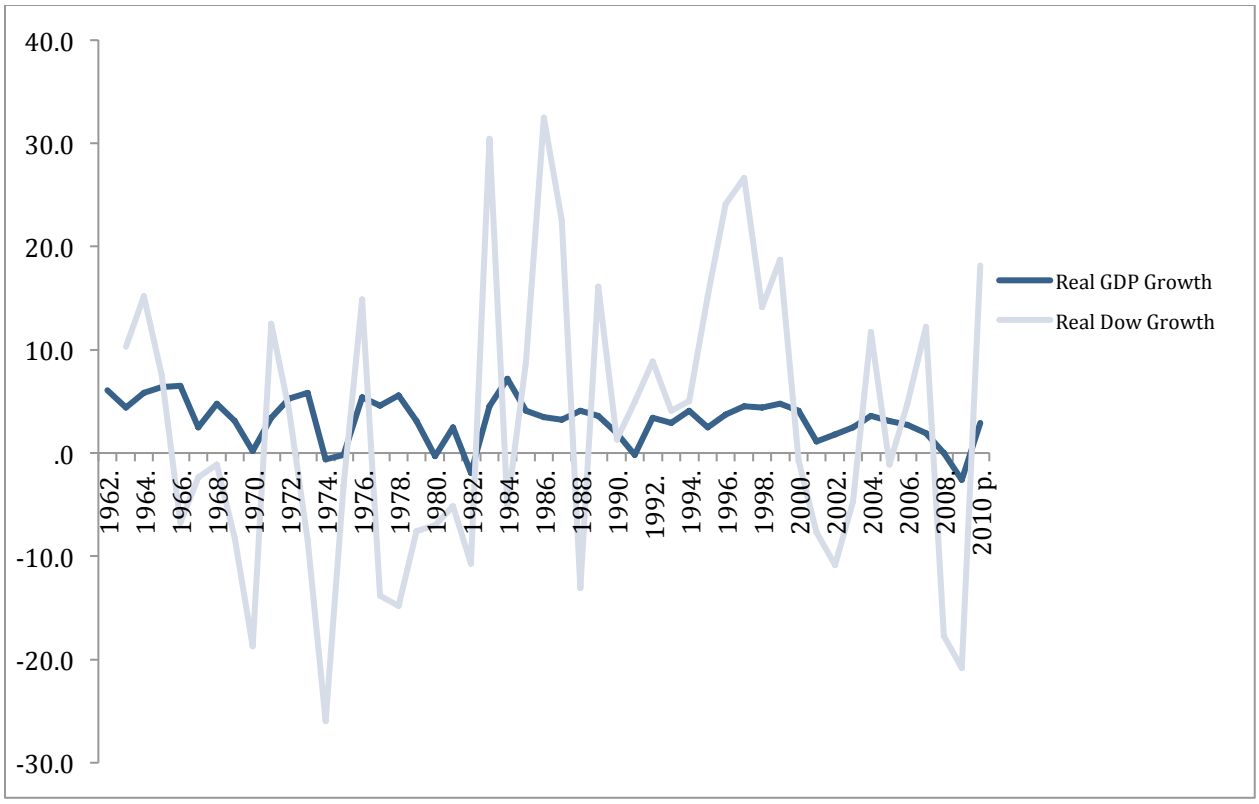


Figure 1.4: Real GDP Growth vs. Real DJIA Growth
Source: Economic Report of the President

Economic effects of the stock market are notable in the wealth effect, as an increase in the stock prices causes an increase in personal wealth, and consequently an increase in consumer spending, a component of GDP. Investment is similarly affected, with higher stock prices translating into more money per share raised by a firm to finance investment projects. Along with economic swings, the stock market can itself affect consumer and business confidence, discouraging people from spending during bear markets. By itself, the stock market may not have much of an effect, but when combined with falling home prices, falling stock prices, and rising unemployment it can yield a negative connotation. Further, the crisis in the financial markets is widely viewed as a shock that contributed significantly to the severity of the Great Recession.

1.5 Conclusion

As noted in the introduction, the purpose of this study is to examine potential causes of recent economic volatility while paying attention to the financial sector and its effects on economic growth. Toward this end, this chapter has presented an overview of the interconnection of the financial sector and the determinants of GDP growth. In order to connect the preceding observations to the theoretical determinants of long run growth in the economy, Chapter 2 examines the production function, which shows maximum output that can be produced for given levels of labor and capital input, given the state of technology (Hall, 2005). It is specified as

The Production Function $$\boldsymbol{Y = F(L, K, A)}$$

That is, output *Y* depends on employment *L*, capital *K*, and technology *A*. Characteristics of the theory state that no input yields no output, and similarly, more input yields more output.

Economic growth is largely driven by population growth, the size of the capital stock, and technological advances that allow production to rise over time. Being an indicator of economic health and having the capacity to move markets, GDP provides a great platform to study the relationship between economic activity and the finance industry. Combined with the examination of factors like changes in the size of the capital stock, demand side shocks, technological shocks, the study focuses on the impacts of shocks to GDP growth with a special interest on the FIRE sector over time. Further, market-driven financial innovations supply important insight on the events that led to the recession of 2007 – 2009, and the impact that financial institutions had on the uncertainty of economic growth that has since been experienced.

Once the theoretical issues are fully discussed in Chapter 2, we present the empirical analysis in Chapter 3 through the regression model to examine the relationship between GDP growth and the various explanatory variables. The regression model allows us to quantify the theoretical model of GDP determination with the empirical evidence. In this manner the study evaluates the statistical significance of each explanatory variable in determining GDP growth. Secondly, the regression model through the use of the coefficient of determination explains the strength of the linear relationship between the independent variables and the dependent variable, GDP growth.

Chapter Two: The Determinants of GDP – Theoretical Considerations

2.1 Introduction

To achieve the objective of this study, this chapter examines the relevant economic theory that explains the factors that lead to changes of the potential level of GDP. Studying the determinants of long run economic growth sets a platform to identify all factors that cause shocks to the economy, including the role of the financial sector. According with standard real business cycle doctrine, Greenwald and Stiglitz (1993) make the proposition that supply side effects may be able to explain a significant amount of the variability in economic activity. To begin, there are three important supply side determinants of long run growth path of output in the economy: labor, capital, and technology. To further explain the role of these determinants, this chapter focuses on the production function and the relationship between inputs and outputs, labor demand, labor supply, and the law of diminishing returns. It explains the four shift factors that are an integral part of GDP determination – changes in technology, changes in capital stock, changes in labor supply due to an increase in population, and changes in labor supply due to an increase in willingness to work. Analyzing the labor supply side curve, we explain the influences of the income and substitution effects on real wages. Further, based on the analysis of labor supply and demand, and the equilibrium level of employment, we examine the optimal level of employment in the labor market. This chapter uses comparative static analysis based on labor supply, labor demand, and the production function to determine the impact of factors that lead to a change on equilibrium real wages, equilibrium employment, and the potential level of GDP. Finally, the chapter examines the determinants of GDP from the demand side.

2.2 Supply Side Analysis: The Production Function and Labor Demand

To represent how the use of labor, capital, and technology combine through the production function to produce output, we turn to the characterization of the production function. Hall and Papell (2005) explain that the production function shows how much output can be produced from given amounts of labor, capital, and technology. Labor input is dependent on growth in the number of people available to work, which has become an essential source of economic development. Similarly, increases in the capital stock enable the economy to produce more output, as the capital stock generally increases from one year to the next. The state of technology determines how much output can be produced given the amount of labor and the stock of capital used in production. Koenig (2000) states that technological improvements are a significant source of productivity growth where we can expect improvements in the production process by means of better equipment and better management. Assumed characteristics of the production function include that no input implies no output, and similarly, to increase output there must be an increase in input. Further, if one input is fixed, say capital, as labor input is increased, output will increase as well. However, the extra output produced by the extra labor will tend to decrease. Figure 2.1 illustrates how output changes with various levels of employment and shows the diminishing marginal product of labor as the production function increases at a decreasing rate (Hall and Papell, 2005).

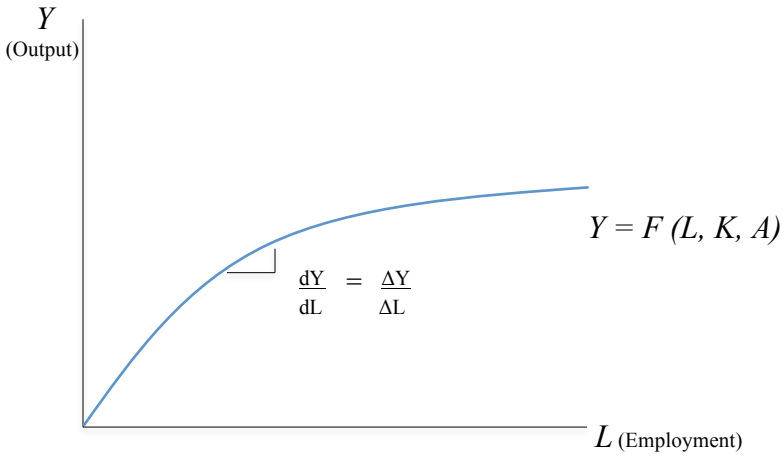


Figure 2.1: The Production Function in Terms of Labor Input

Figure 2.2 illustrates the effects of factors such as technological advances or an increase in the capital stock. These factors cause the production function to shift up, as each level of labor input is now associated with more output.

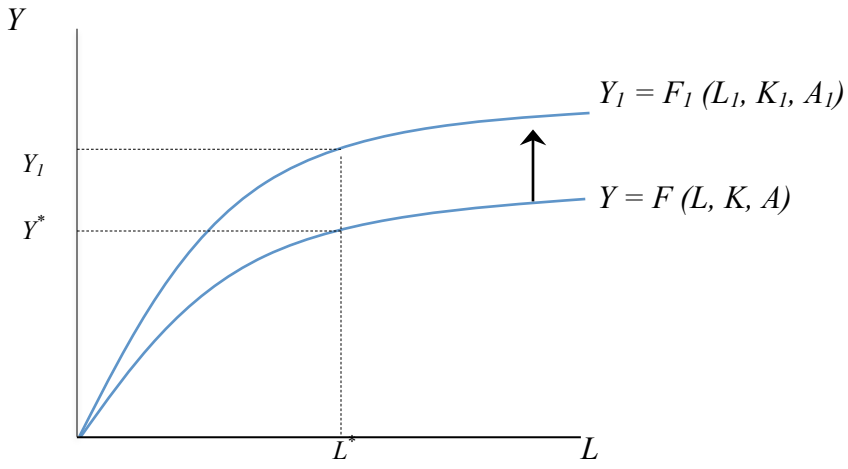


Figure 2.2: Shift in the Production Function

The slope of the production function is the marginal product of labor, the change in output brought about by a 1-unit rise in labor, or the extra output produced by the extra worker (Hall

and Papell, 2005). Figure 2.3 illustrates how the marginal product of labor, indicated by MP_L, declines as the amount of employment rises, consistent with the declining slope of the production function.

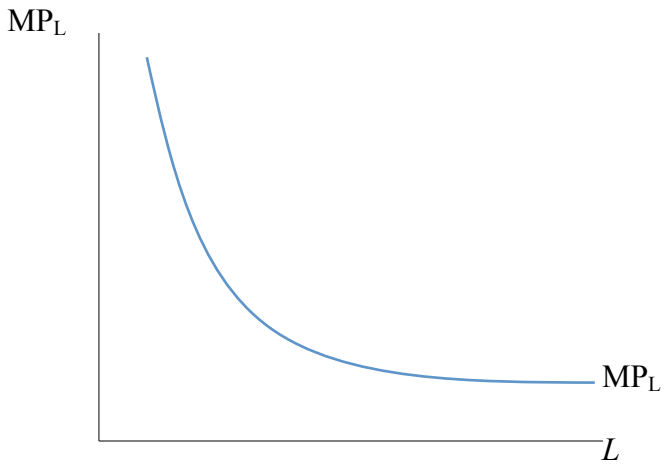


Figure 2.3: Marginal Product of Labor Function

As with the production function, technological advances or changes in the capital stock cause the marginal product of labor function to shift up.

The optimal quantity of labor input rule states that firms should continue to hire additional units of labor input as long as the extra benefit of employing the worker, the marginal product of labor, is greater or equal to the real cost of employing the worker, the real wage (Hall and Papell, 2005). The real wage, denoted by $\frac{W}{P}$, is the dollar wage W divided by the price level P. In other words, a firm should hire labor as long as the real benefit of hiring an extra worker is greater than or equal to the real cost of that worker. Thus, because the marginal product of labor curve shows how many workers should be hired at each real wage, it is equivalent to the labor demand curve (denoted by L^d) as illustrated in Figure 2.4.

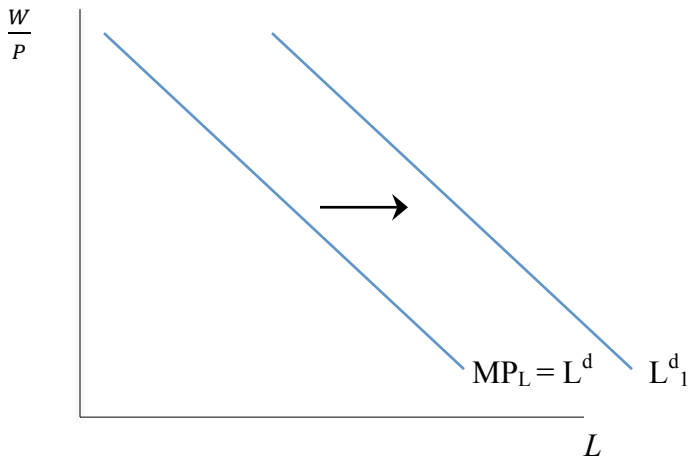


Figure 2.4: Labor Demand Curve

Since it is the same as the marginal product curve, the labor demand curve will shift up given technological advances and an increase in the capital stock. The labor demand curve is a downward-sloping relation between the real wage and the level of employment. For each real wage, it gives the level of employment that firms choose by equating the marginal product of labor to the real wage. However, to determine the real wage, the labor supply curve is required along with labor demand.

2.3 The Labor Supply Curve

Labor supply is the amount of labor offered in the labor market for various levels of the real wage. Given a rise in the real wage, theory predicts that the quantity of labor supplied will increase because the rise in the real wage increases the opportunity cost of leisure. In this case, the substitution effect is said to dominate. The real wage provides an incentive to work, and people substitute towards work when the real wage rises. In the case of the income effect, given a rise in the real wage, theory predicts that the quantity of labor supplied will decrease, because as the real wage rises people can consume more of all goods including leisure. The rise in real wages makes people better off, and they work less on that account, in which case the income

effect is said to be dominant. Hall and Papell (2005) explain the net effect of the two influences of real wage on labor supply is roughly zero, but the substitution effect slightly dominates the income effect. Empirically, at the macro level, the long-run labor supply curve (denoted by L^s) is almost vertical, as illustrated in Figure 2.5.

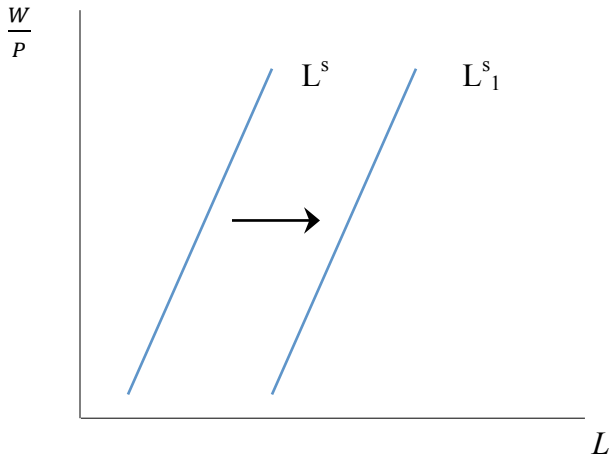


Figure 2.5: Labor Supply Curve

Given an increase in population or an increase in the willingness to work in the labor force will shift out the labor supply curve, from L^s to L^s_1.

2.4 Labor Market Equilibrium

Moving forward to find the optimal level of output in the market, let us examine the labor market at equilibrium. Equilibrium in the labor market occurs at the point where the quantity of labor supplied equals the quantity of labor demanded. The point of intersection between the labor supply curve and the labor demand curve determines the real wage in the labor market, at which point full employment is reached, denoted by L^* in Figure 2.6 (Hall and Papell, 2005)

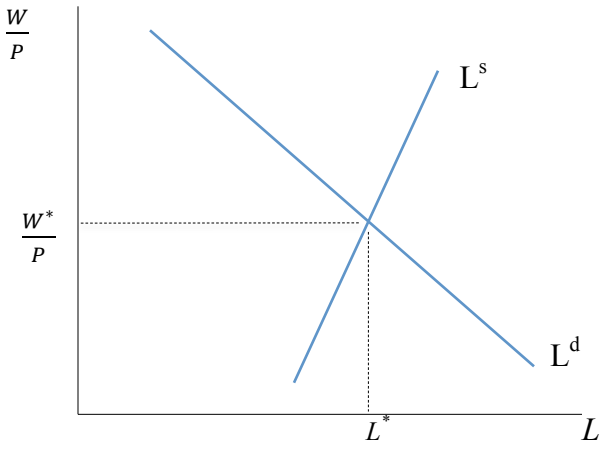


Figure 2.6: Labor Market Equilibrium

However, if the real wage was higher than $\frac{W^*}{P}$ in Figure 2.7, then quantity demanded, L^d_1, is less than the quantity supplied, L^s_1. Hence, there is an excess supply of labor, namely unemployment. In the long run, given the excess supply and competition among workers for jobs, there will be downward pressure on wages. As the wage falls, the quantity of labor demanded rises and the quantity of labor supply falls. Eventually the equilibrium real wage, $\frac{W^*}{P}$, and full employment are restored, as shown by Figure 2.7.

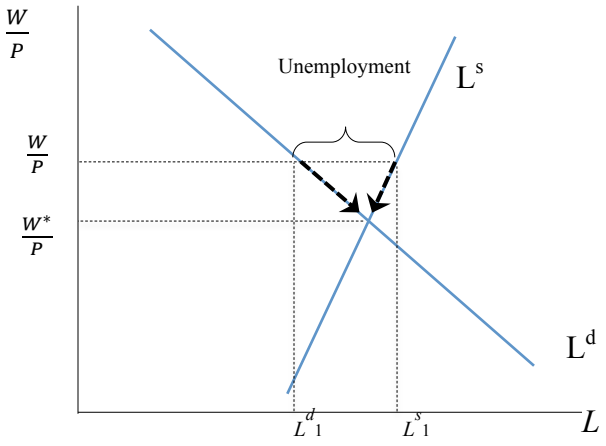


Figure 2.7: Disequilibrium in the Labor Market

2.5 Supply Side Analysis: Finding Potential GDP

In order to examine the components that determine the potential level of GDP, and further demonstrate applications of the model, we use comparative static analysis. The determinants of potential GDP are the labor force and the workers' willingness to work. However, first the potential level of GDP is found. Finding the equilibrium level of labor, L^*, or full employment, and then finding the level of GDP corresponding to that level of employment determines the potential level of GDP. In Figure 2.8, note that potential GDP, denoted by Y_p, equals the level of output produced when $L = L^*$, or full employment.

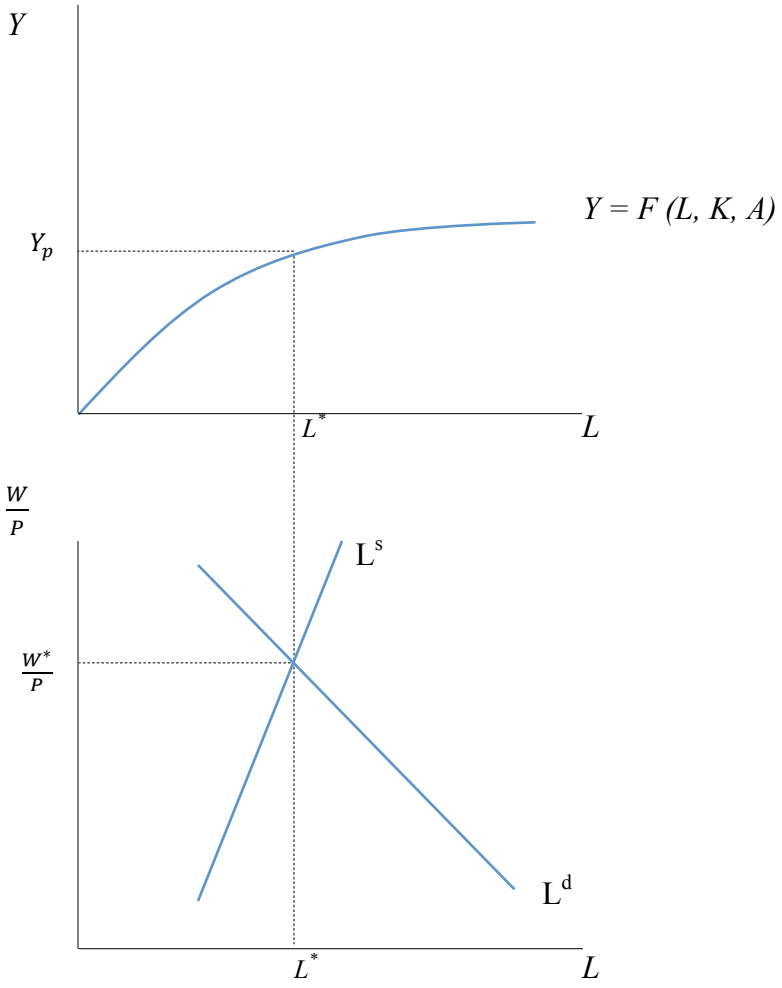


Figure 2.8: Potential Level of GDP

2.6 Comparative Static Analysis: The Effects of Shocks on Economic Output

Comparative static analysis is used by applying the model given various shocks to the economy. First we observe the effects of women entering the labor force on the model and analyze how entry of women into the labor force will affect labor supply. In Figure 2.9, the economy is initially in equilibrium with $L = L^*,\ Y = Y_p^*,\ and\ \frac{W}{P} = \frac{W^*}{P}$. Given an increase in women's labor force participation, labor supply shifts outward to L^s_1, hence, we predict equilibrium employment will rise from L^* to L^1 and potential GDP from Y_p^* to Y_{p1}. Further, this effect causes real wages to fall.

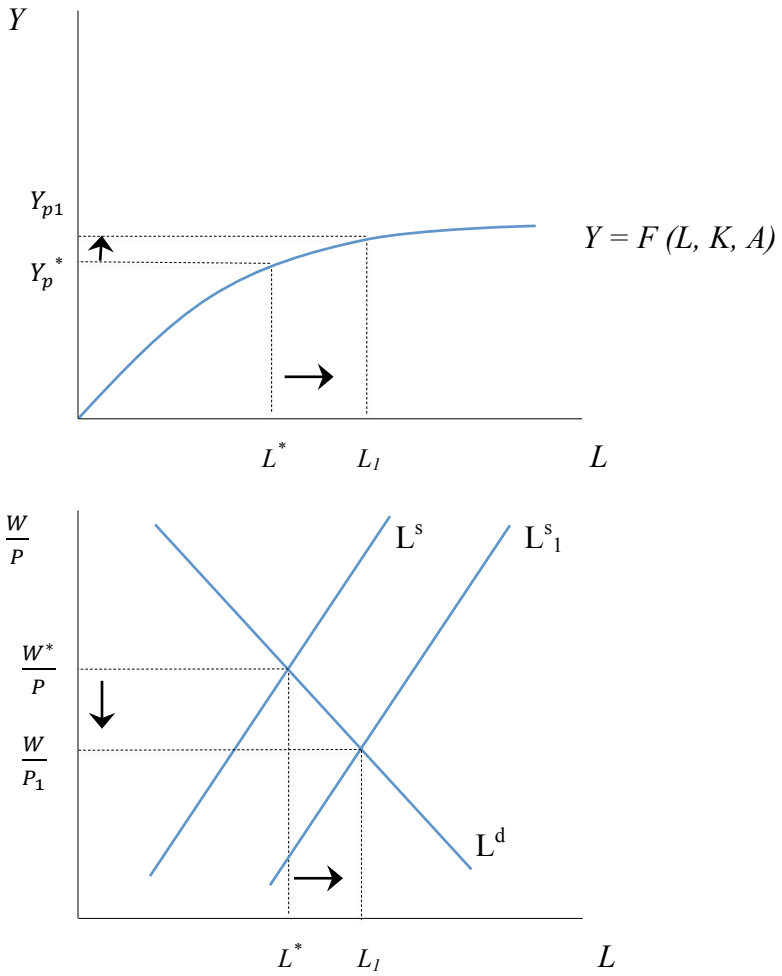


Figure 2.9: Potential Level of GDP – Effects of Women's Labor Force Participation

Initially the economy is in equilibrium with Figure 2.9 illustrating the effects of an increase on labor supply by the entry of women into the labor force. In order to illustrate the opposite effect on potential GDP we think of the effect that baby boomers retiring will have on labor supply. Dohm (2000) implies hindering prospects for economic growth, caused by baby boomer retirement, as the burden on those remaining in the workforce will increase. With a decrease in the labor supply caused by baby boomers leaving the labor force, we can foresee labor supply shifting inward. Hence, we predict equilibrium employment will fall, the equilibrium real wage will rise, and potential GDP will decline. With respect to the objectives of this study, the determinants of GDP growth over time, the labor force participation rate is included as an explanatory variable.

To further demonstrate the theoretical comparative static analysis, consider the effects of technological shock on the economy. Initially the economy is in equilibrium with $L = L^*,\ Y = Y_p^*,\ and\ \frac{W}{P} = \frac{W^*}{P}$. Given an adverse technological shock, the production function shifts from $F(L, K, A)$ to $F_1(L_1, K_1, A_1)$ and labor demand falls from L^d to L^d_1. Therefore we predict a decrease in real wage, a decrease in employment, and a decrease in potential GDP, as illustrated in Figure 2.10.

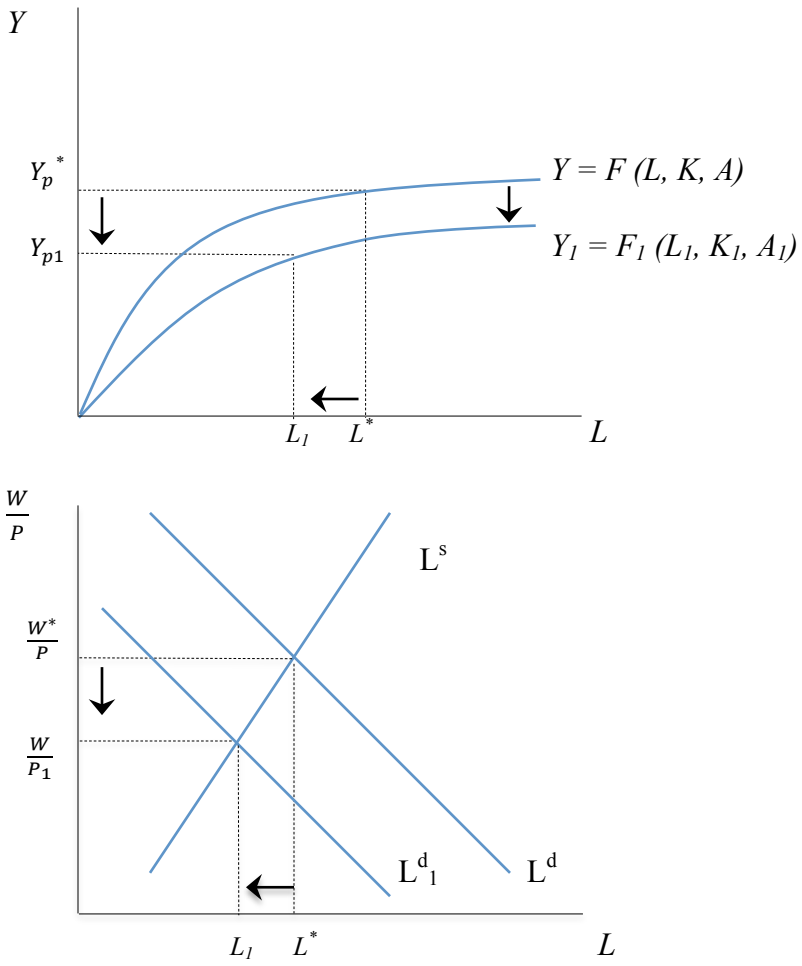


Figure 2.10: Potential Level of GDP – Technological Shock

A similar impact on GDP is predicted given a decline in the capital stock. Hence both technology and changes in the capital stock are included as explanatory variables.

2.7 Demand Side Analysis: Changes in Expenditure Categories

To provide a more comprehensive understanding of the determinants of economic growth, the study also examines the demand side determinants of GDP. On the demand side, GDP is the sum of the factor payments, the sum of the expenditure components, and the sum of the values added by each sector. Specific to this study, GDP is affected by output in the financial

services sector. The study therefore focuses on the sum of values added by each sector. For simplicity assume that there are four sectors of the economy, manufacturing, construction, financial services, and other. From the value added approach, GDP, *Y*, equals the sum of the values added:

$$Y = VA_M + VA_C + VA_{FS} + VA_O,$$

where GDP and value added is a function of time, *t*. Taking the derivative of GDP with respect to time,

$$\frac{dY}{dt} = \frac{dVA_M}{dt} + \frac{dVA_C}{dt} + \frac{dVA_{FS}}{dt} + \frac{dVA_O}{dt}. \qquad (2.1)$$

Forming the growth rate of GDP, $\frac{dY}{dt} \cdot \frac{1}{Y}$, leads to the following equation

$$\frac{dY}{dt} \cdot \frac{1}{Y} = \frac{dVA_M}{dt} \cdot \frac{1}{Y} + \frac{dVA_C}{dt} \cdot \frac{1}{Y} + \frac{dVA_{FS}}{dt} \cdot \frac{1}{Y} + \frac{dVA_O}{dt} \cdot \frac{1}{Y}.$$

Next, each term on the right side of the equality is multiplied by one, written as $\frac{VA_i}{VA_i}$ to yield

$$\frac{dY}{dt} \cdot \frac{1}{Y} = \frac{VA_M}{Y}\left(\frac{dVA_M}{dt} \cdot \frac{1}{VA_M}\right) + \frac{VA_C}{Y}\left(\frac{dVA_C}{dt} \cdot \frac{1}{VA_C}\right) + \frac{VA_{FS}}{Y}\left(\frac{dVA_{FS}}{dt} \cdot \frac{1}{VA_{FS}}\right) + \frac{VA_O}{Y}\left(\frac{dVA_O}{dt} \cdot \frac{1}{VA_O}\right)$$

Note that the term $\frac{VA_i}{Y}$ represents the value share of sector *i*, S_i, while $\frac{dVA_i}{dt} \cdot \frac{1}{VA_i}$ is the growth rate of value added for sector *i,* g_i. Thus, based on the value added approach, the growth rate of GDP, g_Y, equals the value added share weighted sum of the growth rates of value added for each sector:

$$g_Y = S_M g_M + S_C g_C + S_{FS} g_{FS} + S_O g_O \qquad (2.2)$$

This equation shows how the growth rate of GDP is affected by the value added of each sector. The role of the financial services sector and its effects on economic performance are particularly important as the sector enables the flow of funds from investors to borrowers, which contributes to economic growth. The financial sector also permits households and firms to manage unanticipated shocks. Herring and Santomero (1995) indicate that, if efficient, the sector reduces the costs and risk of production and services, which leads to an increase in the standard of living. Based on equation (2.2), GDP will grow if the growth rate of the financial services sector rises. In addition, the innovations in the financial services sector may have spillover effects that can lead to higher rates of growth in value added for other sectors. Alternatively, as seen in the most recent recession, these spillover effects can also be highly contractionary. These effects are measured in the empirical model using value added shares. Therefore, there are no a priori expectations regarding the effects of changes in the shares on GDP, but there is in terms of the growth rates.

2.8 Other Demand Side Factors: The IS and LM Curves

To understand the economic relationship between spending behavior and GDP we look to the IS and the LM curves to demonstrate the relationship between interest rates and output in the commodity and money markets. To see where spending occurs in the commodity market we look to the IS curve, which shows all the different "combinations of the [interest rate and income] that satisfy the income identity [i.e., the point where GDP equals expenditure], the consumption function, the investment function, and the net exports function" (Hall & Taylor, p. 179). In other words, the IS curve shows all combinations of interest rate and GDP that keep the commodity market in equilibrium. Notable is the fact that the IS curve is downward sloping, and thus the higher levels of the interest rate lead to lower levels of GDP along the curve, as illustrated by Figure 2.11. The IS curve is downward sloping, because higher interest rates reduce investment and net exports and therefore reduce GDP through the multiplier process.

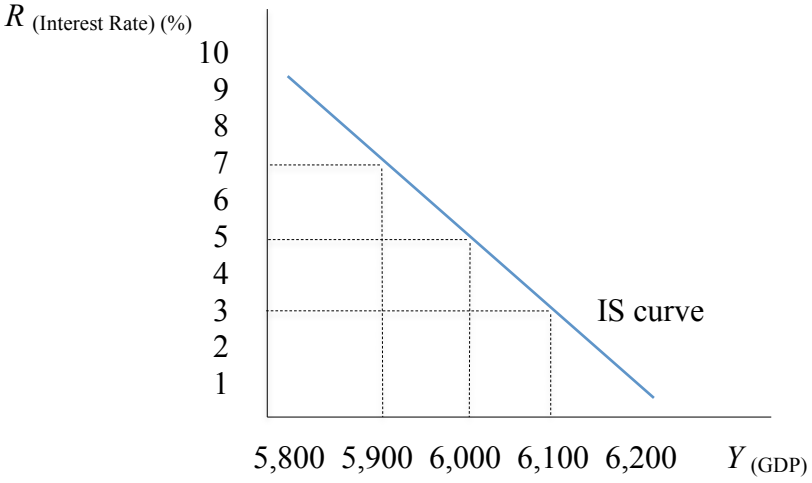


Figure 2.11: The IS Curve

Secondly, consideration is given to factors that shift the IS curve, and which are expected to affect GDP growth, namely changes in government spending, taxes, consumer confidence,

consumer wealth, investor confidence, and the price of capital at every interest rate. For example, an increase in government spending shifts the IS curve outward, to the right, and thus an increase in government spending or the deficit increases GDP through the multiplier. Conversely, a decrease in government spending or the deficit shifts the IS curve inward, to the left, and consequently GDP declines at each interest rate. Inventories, a part of investment, are also predicted to affect GDP. During booms, rising inventories help stimulate GDP. However, during recessions, rising inventories imply that GDP will fall, as firms are not selling their output. Finally, increased consumer debt is expected to raise GDP at all interest rates as increased consumer debt enables consumers collectively to increase consumer spending, a component of GDP.

To understand money market equilibrium, we look to the LM curve, which shows all "combinations of the [interest rate and income] that satisfy the money demand relationship for a fixed level of the money supply and for a predetermined value of the price level" (Hall & Taylor, p. 183). In other words, the LM curve shows all combinations of interest rate and GDP that keep the money market in equilibrium. The LM curve is upward sloping and thus the higher levels of interest rate are related with higher levels of GDP along the curve, as seen in Figure 2.12. For simplicity, note that the demand for real money depends positively on real GDP and negatively on the interest rate, and thus, since rises in GDP raise money demand, which raises the equilibrium interest rate, the LM curve is upward-sloping. Factors that shift the LM curve are increases or decreases in the money supply. An increase in the real money supply shifts the LM curve out, to the right. Conversely, a decrease in the real money supply shifts the LM curve in, to the left. So the effects of changes in the real money supply and Federal Reserve policy join the list of factors that affect GDP growth.

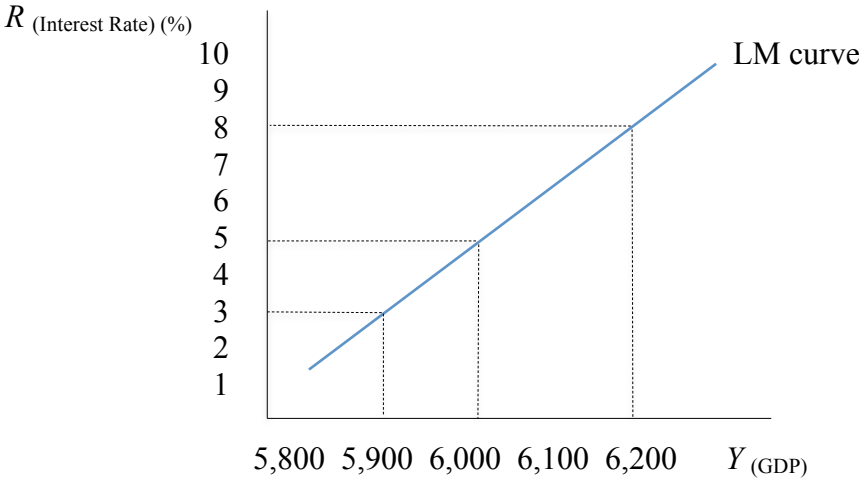


Figure 2.12: The LM Curve

The IS-LM equilibrium is derived by finding the combination of GDP and the interest rate that satisfy both spending balance and money market equilibrium. Recall, the IS curve shows all combinations of the interest rate and income that satisfy spending balance. The LM curve shows all combinations of the interest rate and income that satisfy money market equilibrium. Hence, given the price level, the IS-LM intersection reveals the equilibrium level of GDP and interest rate, as shown in Figure 2.13.

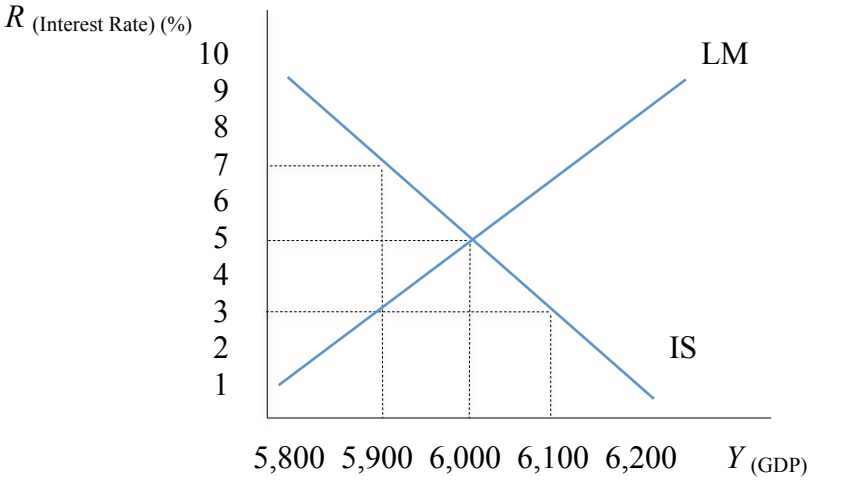


Figure 2.13: The IS-LM Model

With an increase in the price level, perhaps caused by an increase in energy prices the LM curve shifts left, which raises interest rates and reduces output, resulting in a negative relationship between price level and GDP. The negative relationship between price level and GDP is summarized in the aggregate demand relationship, which reflects all the combinations of interest rate and GDP that keep both the money and commodity markets in equilibrium.

2.9 Conclusion

This chapter presented the theoretical causes from both the supply and demand side that lead to changes in the potential level of GDP. The theoretical analysis also presented the role of the financial services sector in regard to economic performance. In the following chapter an empirical analysis is used to help establish the quantitative relationship between GDP and the factors that have a positive or adverse effect on the economy. The goal is to determine the pro-cyclical or countercyclical nature of the explanatory variables with a special focus on the effects of financial institutions on economic growth. Based on the theoretical considerations presented, it is expected that GDP will rise given an increase in labor supply. Similarly, we expect GDP to fall given a decrease in labor supply when workers exit the labor market. Theoretical considerations of supply side analysis also predict that adverse technological shocks and a decrease in the capital stock will cause GDP, to fall. Demand side analysis predicts that GDP will rise given a rise in government deficit, a rise in consumer wealth, a decline in the price of capital, and a rise in real money supply caused by either a rise in the nominal money supply due to actions by the Federal Reserve or a decline in the price level, i.e., price shocks, such as the oil price based inflation of the 1970s, are expected to cause GDP to decline. Inventories are expected to have an ambiguous effect on GDP. Inventory movements play a major role in business cycle fluctuations. As financing becomes more expensive firms reduce their inventory

holdings, hence it follows that a firm's stock of inventories is dependent on the cost of carry. Blinder and Maccini (1991) report on the fact that declines in inventory investment account for about 87 percent of total peak-to-trough movement in the economy in the postwar period. In addition, changes in value added shares and disruptions that interfere with the ability of the financial sector to intermediate financial flows might therefore be expected to negatively affect economic growth.

Chapter 3: Empirical Analysis

3.1 Introduction

The purpose of this chapter is to combine the theoretical model of GDP determination presented in the previous chapter with the empirical evidence. In order to quantify the theoretical comparative static analysis, we begin the empirical analysis of this study. The presentation of results in this chapter takes a straightforward approach, focusing on the key elements of regression analysis and the quality of the model. Chapter 4 presents a more comprehensive interpretation of the statistical results in order to evaluate key factors that led to the Great Recession. Regression analysis is used to predict the value of one variable on the basis of other variables. This technique involves developing a mathematical equation that describes the relationship between the variable to be forecasted, called the dependent variable, and the variables that the statistics practitioner believes are causally related to the dependent variable. The dependent variable is denoted *Y*, whereas the related variables are called independent variables and are denoted $X_1, X_2, \ldots, X_k$ (where *k* is the number of independent variables). The general form of the regression model appears as

$$Y_i = \beta_0 + \beta_1 \cdot X_1 + \beta_2 \cdot X_2 + \ldots + \beta_i \cdot X_k + \varepsilon_i,$$

where β_i is the *i*th regression coefficient, which measures the expected change in *Y* given a one unit change in *X*. The final term, ε_i, is the error term. In general, we include as many independent variables as are believed to affect the dependent variable. Arbitrarily limiting the number of independent variables also limits the usefulness of the model. Including as many independent variables as the theoretical model indicates are important leads to a regression

model that is more properly specified than a simple linear regression model. We use the model by estimating and interpreting the coefficients.

In general, we assume that *k* independent variables are potentially related to the dependent variable. Based on the theory presented in Chapter 2, the fundamental equation of the sample regression model in this study is:

$$Y = \beta_0 + \beta_1 M + \beta_2 S + \beta_3 P + \beta_4 G + \beta_5 V + \beta_6 I + \beta_7 N + \beta_8 L + \beta_9 R + \beta_{10} D + \varepsilon,$$

where Y is the dependent variable, GDP growth, measured as the percent change of real GDP from one year to the next; β_0 is the model's intercept, the level of GDP growth when all other independent variables are equal zero; M is the measure of FIRE share relative to manufacturing share; S is the measure of FIRE share relative to services share; P is the measure of productivity growth, a measure of technological change; G is the measure of mortgage debt growth; V is the measure of investment growth; I is the inflation rate which captures the effects of supply shocks; N is the measure of inventory growth; L is the measure of labor force participation; R is the federal funds rate and captures the effects of monetary policy; and D is the measure of Dow Jones growth, a measure of consumer wealth and investor confidence.

3.2 Coefficient Sign Expectations for the Model

Each coefficient β_i shows us the percent change in real GDP growth expected to occur given a one percent increase in its corresponding independent variable, holding all other variables constant. Regarding the variables M and S, based on the theoretical model, the change in value added growth lead to change in value added shares. Depending upon the nature of those changes in value added growths and the changes in value added shares, the growth rate of GDP

will be affected either positively or negatively. Therefore, in terms of FIRE share relative to manufacturing share and FIRE share relative to services share, there are no a priori expectations based upon the theoretical model. In terms of the ratio of the shares, a negative coefficient will imply that, when FIRE grows more than services for instance, FIRE is having an adverse effect on GDP growth, which is shown in the empirical model, but is not an a priori expectation. Further, based on the theory presented in Chapter 2, we have the following expectations regarding changes in real GDP growth given changes in each of the explanatory variables.

Productivity: On the supply side the expected effect of a rise in productivity growth, a proxy for technological change, is to cause an increase in GDP. Initially productivity is measured as output per hour for all persons in the business sector as a percent change from the preceding period. Thus, as illustrated in Figure 2.10, one expects the sign of the coefficient of productivity to be positive. The theoretical considerations, as discussed by the supply side analysis of this study, emphasize the point that technological improvements are a significant source of productivity growth.

Mortgage Debt: On the demand side, a one percent rise in mortgage debt is expected to either cause GDP to rise or decline. The initial mortgage debt data are measured as debt outstanding by all properties. Given the housing market, as reflected by mortgage debt, an increase in mortgage debt enables consumers collectively to increase consumer spending. Conversely, a decrease in mortgage debt, theoretically, would lead to a decrease in consumer spending. Recall GDP is the sum of the factor payments, the sum of the expenditure components, and the sum of the values added by each sector.

Investment: The expected effect of a one percent rise investment growth is to cause GDP to rise. Investment data are measured as gross private investment in equipment and software as a percent change from the preceding period. Therefore, based on theoretical considerations, an increase in investment is to have the expected sign of the coefficient of investment be positive. Increases in the capital stock enable the economy to produce more output, as the capital stock generally increases from one year to the next.

Inflation: A rise in the inflation rate is expected to cause GDP to rise during booms and cause GDP to decline during supply shocks, so the effect is ambiguous. If demand is growing faster than supply, then prices will increase, which usually occurs when the economy is growing. Further, if the costs of a firm increase then, consequently, it must increase prices to maintain profit margins. Increased costs can include wages, taxes, or an increase in the costs of imports. Alternatively, during a supply shock, inflation triggers an increase in the price of goods and services considered to be essential and somewhat difficult to substitute. Consider the supply shock inflation triggered by the oil crisis of the 1970s, which exhibited a substantial increase in the cost of an important good where not a suitable alternative was available.

Inventories: With inventories, a rise in its growth rate is expected to have an ambiguous effect on GDP; rising inventories during expansions lead to increases in GDP, but rising inventories during recessions is expected to cause a decline. Inventories are essentially the amount of all products available to sell to other businesses and/or consumers. Firms add to inventories during booms to protect against unexpected rise in demand, which cause GDP growth. However, during recessions, rising inventories imply that GDP will fall, as firms are not selling their output.

Labor Force Participation Rate: As an indicator of labor supply, as discussed in Chapter 2, the determinants of potential GDP are the labor force and the workers' willingness to work. A rise in labor force participation rate is expected to cause GDP to rise. An excess supply of workers will shift labor supply outward, and hence predict potential GDP to rise. Therefore, one expects the coefficient sign of the labor force participation rate to be positive. However, a decrease in workers predicts labor supply to shift inward, thus causing GDP to decline.

Interest Rate: A rise in the interest rate is expected to cause GDP to decline or rise. However, during expansions interest rates tend to rise, so the effect is ambiguous. The Federal Reserve exercises substantial control over the federal funds rate. The federal funds rate is the interest rate at which depository institutions trade balances, held in accounts at their Reserve Banks, in the federal funds market. The Federal Reserve through its influence over the supply of and demand for balances at Reserve Banks can control these interest rates. A change in the federal funds rate can affect other short-term interest rates, long-term interest rates, the foreign exchange value of the dollar, and stock prices.

Dow Jones Industrial Average: A rise in Dow growth is expected to cause GDP to rise. An increase in the stock prices causes an increase in personal wealth, which leads to an increase in consumer spending, a component of GDP. Dow growth is also reflective of investor confidence. Further, during both economic booms and busts, the stock market is volatile in behavior as it is highly sensitive to economic changes.

Thus, performing this study, productivity growth, investment growth, labor force participation rate, and Dow growth, should have a positive effect on the growth of real GDP. Further, the effects of mortgage debt, inflation, inventories, and the interest rate are expected to be ambiguous.

3.3 Regression: Empirical Evidence of Variables Affecting GDP Growth

The theoretical model is now tested using empirical data for the ten independent variables. When the initial regression is run using all ten variables the output obtained is shown in Table 3.1. There are three important subperiods into which the variables are broken down and tested: the period before the Great Moderation, 1964 – 1982; the Great Moderation, 1983 – 2001; and the post 9/11 2001 and the Great Recession era. Recall, the Great Moderation was the period, beginning in the early 1980s, where major economic variables declined in volatility and the economy experienced long economic expansions. Subsequently, each independent variable of interest is divided based on these time periods, creating three new variables, each corresponding to one of the subperiods described. For instance, the ratio of FIRE share relative to manufacturing share is divided among the three subperiods: in the first period the variable contains share ratio values for the years 1964 – 1982, and will take on a value of zero otherwise; in the second period, the variable contains share ratio values for the years 1983 – 1999, and take on a value of zero otherwise; lastly, in the third period, the variable contains share ratio values for the years 2000 – 2009, and will take on a value of zero otherwise. Consequently the FIRE-Manufacturing share ratio becomes firmansh1 – the ratio of FIRE share relative to manufacuring share in period one; firmansh2 – the ratio of FIRE share relative to manufacturing share in period two; and firmansh3 – the ratio of FIRE share relative to manufacturing share in period three. With this process we effectively create coefficients that capture the unique effects of each respective time period. Moreover, this methodology is applied to the ratio of FIRE share relative to services share, mortgage debt growth, investment growth, inflation, labor force participation rate, interest rate, and Dow growth. In addition to the variables described above, two dummy variables are included. The first is dumrec, which takes on a value of one during

recessions and zero otherwise. It is expected to have an inverse relation with GDP growth, since recessions cause GDP growth to decline. The second is strucdum, which takes on a value of one during the period of time known as the Great Moderation and zero otherwise. Since GDP growth was more stable in this period strucdum is expected to be positively correlated with GDP growth.

Table 3.1: Regression Output for Real GDP Growth

Source	SS	df	MS		
Model	216.950463	25	8.67801851	Number of obs	46
Residual	4.86866911	20	.243433456	F(25, 20)	35.65
				Prob > F	0.0000
				R-squared	0.9781
				Adj R-squared	0.9506
Total	221.819132	45	4.92931404	Root MSE	.49339

gdpgro	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
firmansh1	-.1155651	.0485583	-2.38	0.027	-.2168559	-.0142742
firmansh2	-.0934697	.0869453	-1.08	0.295	-.2748344	.087895
firmansh3	-.0539461	.0283389	-1.90	0.071	-.1130599	.0051678
firservsh1	-.1038312	.1494084	-0.69	0.495	-.4154916	.2078293
firservsh2	-.1395207	.4476017	-0.31	0.758	-1.073202	.7941601
firservsh3	-.2701179	.3609141	-0.75	0.463	-1.022972	.4827358
prodgro	.2743805	.0824837	3.33	0.003	.1023226	.4464384
mtggro1	.1933507	.1155419	1.67	0.110	-.0476654	.4343668
mtggro2	.0949661	.104689	0.91	0.375	-.1234113	.3133434
mtggro3	.057451	.1238261	0.46	0.648	-.2008457	.3157477
invstgro1	.1388881	.040961	3.39	0.003	.0534449	.2243313
invstgro2	.1294576	.0325567	3.98	0.001	.0615456	.1973697
invstgro3	.1507748	.0512481	2.94	0.008	.0438732	.2576764
infl1	-.0721599	.0951005	-0.76	0.457	-.2705361	.1262163
invengro	.1538951	.0673488	2.29	0.033	.0134078	.2943823
lfprate1	.007142	.1625797	0.04	0.965	-.3319934	.3462774
lfprate23	.1020434	.2229488	0.46	0.652	-.3630196	.5671063
irate1	.3094152	.1425467	2.17	0.042	.012068	.6067624
irate2	-.0628297	.2067666	-0.30	0.764	-.4941374	.3684779
irate3	.0604571	.1833859	0.33	0.745	-.3220792	.4429934
dowgro1	.0563534	.0166368	3.39	0.003	.0216496	.0910572
dowgro2	-.007881	.0117772	-0.67	0.511	-.0324478	.0166857
dowgro3	-.011758	.0366454	-0.32	0.752	-.088199	.0646829
dumrec	-.4723407	.3445378	-1.37	0.186	-1.191034	.2463526
strucdum	-.6302234	.6508343	-0.97	0.344	-1.98784	.7273931
_cons	10.43105	9.513296	1.10	0.286	-9.413342	30.27543

3.4 Determining the Significance of the Independent Variables

In terms of analysis, the first step is the evaluation of the significance of each of the explanatory variables in determining GDP growth using a *t* – test at the 5% level. To begin, for productivity growth the null and alternative hypotheses are expressed as follows:

$$H_0 : \beta_0 = 0$$

$$H_1 : \beta_1 > 0$$

The null hypothesis, H_0, implies that productivity growth has no effect on GDP growth. The alternative hypothesis is based on theoretical expectations. That is, when productivity growth rises, GDP growth is expected to rise because with productivity growth, a proxy for technological change, we can expect improvements in the production process by means of better equipment and better management. We find the *t* – statistic by subtracting the hypothesized value from the statistical estimate and then dividing by the estimated standard error, expressed as follows:

$$t = \frac{b_i - \beta}{S_{b_i}} = \frac{b_i}{S_{b_i}} = \frac{.274}{.082} = 3.33$$

The critical value for the *t* – statistic is $t_{20, .05} = 1.725$, and the critical region is illustrated in Figure 3.1.

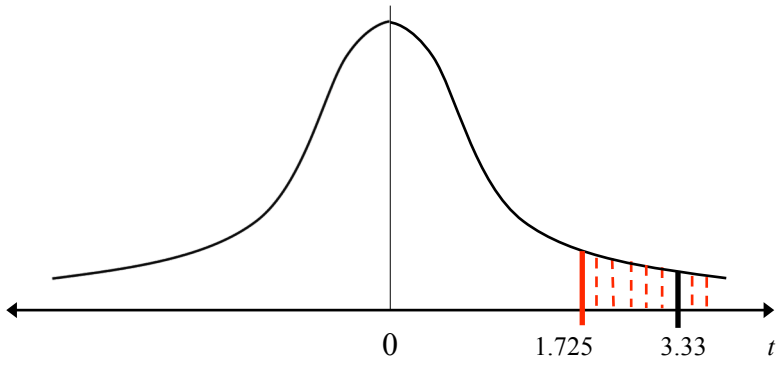


Figure 3.1: Testing for Statistical Significance – The *t*-Test

Based on this evidence, the test statistic for productivity of 3.33 lies in the critical region and we can reject the null hypothesis, H_0. We can conclude that productivity growth is a statistically significant independent variable in determining an increase in GDP.

From the regression output, we can determine that the *t* – statistic for the ratio of FIRE (Finance, Insurance, and Real Estate) share relative to manufacturing share in periods one and three, investment, inventories, and interest rates in the first period, all lie within the critical region, and confirm these are statistically significant in determining GDP growth. Conversely, the coefficients for the ratio of FIRE share relative to service share, mortgage debt growth, inflation in the first period, labor force participation rate, interest rates in the second and third periods, Dow growth in the second and third periods, the dummy variable for recession, and the dummy variable for structural change, are statistically insignificant.

Additionally, the *F* – test is used to test the overall significance of the model where all the independent variables are tested to find their joint significance within the model. In terms of analysis in the evaluation of the significance of the model in determining GDP growth we use the *F* – test at the 5% level. To begin, the null and alternative hypotheses are expressed as follows:

$$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = 0$$

$$H_1 : At\ least\ one\ \beta_i\ is\ not\ equal\ to\ 0$$

The null hypothesis, H_0, states we are testing all the variables simultaneously. By failing to reject the null hypothesis, it is implied that the overall model is insignificant. The critical value for the *F* – statistic is $F_{.05,25,20} = 2.073$, where the critical region is defined by any value greater than 2.073. We reject the null hypothesis where the value for the *F* – statistic is greater than the critical value, and we can conclude that at least one of the variables is significant in terms of the overall model's significance. Reported in Table 3.1, the regression model shows an *F* – statistic of 35.65. Thus, we reject the null hypothesis and can conclude that there is at least one variable having a significant impact on GDP growth, at the 5% level of significance.

3.5 Interpretation of R^2

A second means of evaluating the quality of the model is through use of the coefficient of determination, R^2, which is defined as the proportion of the total sample variability of the dependent variable from its mean explained by the regression. By definition, in equation form,

$$R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}\ , \text{where } 0 \leq R^2 \leq 1,$$

In this equation, SSR is the sum of squares for regression, and SSE is the sum of squares for error. The model variability is partitioned into the components

$$SST = SSR + SSE$$

where,

$$Total\ Sum\ Squares = Regression\ Sum\ of\ Squares + Error\ Sum\ of\ Squares$$

In other words, *SST*, the measure of total variation in GDP growth, equals the sum of explained variability of GDP growth by the independent variables, *SSR*, plus unexplained variability of the

error terms, *SSE*. Thus, in the R^2 formula, $\frac{SSE}{SST}$ measures the unexplained deviation, the proportion of the variation in GDP growth that cannot be explained by the regression; and $1 - \frac{SSE}{SST}$ measures the explained deviation, the proportion of the variation in GDP growth that can be explained by the regression. The coefficient of determination, R^2, describes the strength of the linear relationship between the independent variables and the dependent variable. The regression output in this study gives an R^2 of .9781. Note then that 97.81% of the variation of GDP growth from its mean is explained by this regression model.

3.6 Testing for Multicollinearity

Multicollinearity occurs when two or more independent variables are highly correlated. The presence of multicollinearity implies that the standard errors of the slope coefficient rise in value so that when coefficients are tested the *t*-statistics $\frac{b_i}{S_{b_i}}$ will be small, which leads to the inference of no linear relationship between the affected independent variables and the dependent variable (Keller, 2009). To test for multicollinearity in the regression a pair-wise matrix showing the correlation coefficients for each of the independent variables is generated, as shown in Table 3.2.

Table 3.2: Testing for Multicollinearity – Correlation between Independent Variables

	gdpgro	firman~1	firman~2	firman~3	firser~1	firser~2	firser~3
gdpgro	1.0000						
firmansh1	0.0130	1.0000					
firmansh2	0.2039	-0.6674	1.0000				
firmansh3	-0.3579	-0.4103	-0.3937	1.0000			
firservsh1	0.0526	0.9966	-0.6699	-0.4118	1.0000		
firservsh2	0.2198	-0.6683	0.9980	-0.3943	-0.6708	1.0000	
firservsh3	-0.3404	-0.4112	-0.3946	0.9958	-0.4127	-0.3952	1.0000
prodgro	0.3873	-0.1207	-0.0238	0.1237	-0.1043	-0.0152	0.1339
mtggro1	0.5495	0.5326	-0.3873	-0.2381	0.5562	-0.3878	-0.2386
mtggro2	0.3316	-0.4796	0.6886	-0.2829	-0.4814	0.7265	-0.2836
mtggro3	-0.0566	-0.3093	-0.2969	0.7177	-0.3105	-0.2973	0.7626
invstgro1	0.5998	0.4818	-0.3562	-0.2189	0.5254	-0.3567	-0.2194
invstgro2	0.3607	-0.5100	0.7661	-0.3009	-0.5119	0.7718	-0.3015
invstgro3	0.3131	-0.0266	-0.0255	0.0375	-0.0267	-0.0255	0.0669
infl1	-0.2072	0.8428	-0.5509	-0.3386	0.8334	-0.5517	-0.3394
invengro	0.8026	0.1984	0.0841	-0.4158	0.2312	0.0914	-0.4010
lfprate1	0.0505	0.9962	-0.6709	-0.4124	0.9985	-0.6718	-0.4133
lfprate23	-0.0652	-0.9939	0.6720	0.4123	-0.9976	0.6724	0.4137
irate1	-0.1766	0.8976	-0.5775	-0.3550	0.8831	-0.5783	-0.3558
irate2	0.2409	-0.6531	0.9643	-0.3853	-0.6555	0.9765	-0.3861
irate3	-0.2835	-0.3912	-0.3755	0.9412	-0.3927	-0.3760	0.9530
dowgro1	0.3399	-0.2977	0.1908	0.1173	-0.2878	0.1910	0.1175
dowgro2	0.1275	-0.4068	0.6045	-0.2400	-0.4083	0.6112	-0.2405
dowgro3	0.3717	0.1223	0.1106	-0.3108	0.1227	0.1106	-0.2872
dumrec	-0.6580	0.0916	-0.2381	0.2461	0.0674	-0.2457	0.2339
strucdum	0.1069	-0.8339	0.7170	0.1439	-0.8370	0.7140	0.1719

	prodgro	mtggro1	mtggro2	mtggro3	invstg~1	invstg~2	invstg~3
prodgro	1.0000						
mtggro1	0.3033	1.0000					
mtggro2	0.1012	-0.2783	1.0000				
mtggro3	0.1697	-0.1795	-0.2133	1.0000			
invstgro1	0.1497	0.8153	-0.2559	-0.1651	1.0000		
invstgro2	0.0207	-0.2959	0.6178	-0.2269	-0.2722	1.0000	
invstgro3	-0.1696	-0.0154	-0.0183	0.4663	-0.0142	-0.0195	1.0000
infl1	-0.3554	0.1427	-0.3959	-0.2553	0.2274	-0.4210	-0.0219
invengro	0.0616	0.4041	0.1391	-0.0527	0.5195	0.3095	0.4490
lfprate1	-0.1017	0.5619	-0.4821	-0.3109	0.5204	-0.5127	-0.0267
lfprate23	0.0833	-0.5767	0.4766	0.3130	-0.5304	0.5152	0.0278
irate1	-0.3213	0.1884	-0.4150	-0.2676	0.2786	-0.4413	-0.0230
irate2	-0.0098	-0.3789	0.7622	-0.2905	-0.3485	0.7476	-0.0249
irate3	0.0474	-0.2270	-0.2698	0.7542	-0.2088	-0.2869	0.2203
dowgro1	0.5164	0.2124	0.1371	0.0884	-0.0442	0.1458	0.0076
dowgro2	0.0439	-0.2360	0.6043	-0.1809	-0.2171	0.3919	-0.0155
dowgro3	-0.1579	0.0709	0.0789	0.1633	0.0653	0.0836	0.7656
dumrec	-0.2621	-0.3077	-0.3258	-0.0897	-0.2223	-0.3670	-0.2911
strucdum	0.0509	-0.4839	0.4634	0.3686	-0.4450	0.5688	0.2216

Table 3.2, continued: Testing for Multicollinearity – Correlation between Independent Variables

	infl1	invengro	lfprate1	lfpra~23	irate1	irate2	irate3
infl1	1.0000						
invengro	0.0368	1.0000					
lfprate1	0.8371	0.2303	1.0000				
lfprate23	-0.8204	-0.2382	-0.9991	1.0000			
irate1	0.9376	0.0657	0.8759	-0.8600	1.0000		
irate2	-0.5391	0.0952	-0.6565	0.6548	-0.5651	1.0000	
irate3	-0.3229	-0.3211	-0.3933	0.3941	-0.3385	-0.3674	1.0000
dowgro1	-0.5240	0.0081	-0.2985	0.2841	-0.4528	0.1867	0.1118
dowgro2	-0.3358	-0.0326	-0.4089	0.4084	-0.3520	0.5764	-0.2288
dowgro3	0.1009	0.5155	0.1229	-0.1225	0.1058	0.1082	-0.1114
dumrec	0.1704	-0.5574	0.0577	-0.0471	0.2622	-0.2251	0.2436
strucdum	-0.6883	0.0441	-0.8383	0.8429	-0.7215	0.6765	0.1651

	dowgro1	dowgro2	dowgro3	dumrec	strucdum
dowgro1	1.0000				
dowgro2	0.1163	1.0000			
dowgro3	-0.0349	0.0715	1.0000		
dumrec	-0.2157	-0.2403	-0.2527	1.0000	
strucdum	0.2384	0.3500	0.0743	-0.2548	1.0000

The independent variables are considered highly correlated if the correlation coefficients between two of the independent variables is greater than .90. Table 3.2 shows the correlation coefficients of the FIRE share relative to manufacturing share and FIRE share relative to services share to be highly correlated with one another in each of their respective time periods. For instance, FIRE share relative to manufacturing share in period one is highly correlated to FIRE share relative to services share in period 1, with a correlation coefficient of .9966. Hence, multicollinearity is present, and the low *t* – statistics and significance of independent variables based on *t* – statistics could be affected.

Further, the Durbin-Watson test is used to test for autocorrelation in a time series, and thus it is performed here to test the model. When performing the regression we make the assumption that the error terms are independent of one another, but if the data set has significant autocorrelation this assumption is violated. A Durbin-Watson statistic value close to 2 indicates

non-autocorrelation, a value close to 0 indicates positive autocorrelation, and a value close to 4 indicates negative autocorrelation. Testing for autocorrelation, the model reports a Durbin-Watson *d*-statistic of 2.26, indicating a lack of significant correlation between the independent variables.

3.7 Coefficient Interpretations

The model in this study has exhibited multicollinearity among various independent variables, however, in spite of this violation of assumptions, our estimates are unbiased and efficient. Multicollinearity in the model may explain the low *t* – statistics reported among the independent variables representing the finance sector, namely between FIRE share relative to manufacturing share and FIRE share relative to service share. When reflecting the overall focus of the analysis on the last recession, the regression model shows what our object of interest, FIRE, is doing relative to manufacturing and services. The growth in the share of FIRE generally leads to less growth in GDP, especially when it rises with respect to manufacturing. Manufacturing growth can be argued to be a better stimulus than FIRE, since manufacturing is a tangible good and FIRE is a financial service. Thus, the regression model reports a 1 percent increase in FIRE share relative to manufacturing share is expected to cause a .1155 percent decrease in GDP in period one, a .0934 percent decrease in period two, and a .0539 percent decrease in period three, holding all other independent variables constant. We note FIRE share relative to manufacturing share in terms of GDP growth has a much greater adverse effect in the first period. Similarly, a 1 percent increase in FIRE share relative to services share is expected to cause a .1038 percent decrease in GDP growth in period one, a .1395 percent decrease in period two, and a .2701 percent decrease in period three, holding all other variables constant. The effect of FIRE output relative to service output in terms of GDP growth is much more

pronounced in the Great Recession period. For the most part, as FIRE grows relative to manufacturing and services, it mostly has an adverse affect on GDP, all else constant. In terms of the value added growth model from Chapter 2, it would be better to have a growing manufacturing share that would do more for GDP than a FIRE share, and the same thing holds true for services.

Next, productivity, a measure of technological change, is expected to cause an increase in GDP, as predicted by the theoretical model. The regression model effectively shows a 1 percent increase in productivity, for all three periods, to cause a .2743 percent increase in GDP, holding all other variables constant.

Mortgage debt growth truly being an important variable behind growth throughout the entire time period, faded in importance during the Great Recession era via the collapse of the housing market. The effect of mortgage debt is effectively much weaker in the last period than it is in the previous periods. The regression model indicates that a 1 percent increase in mortgage debt is expected to cause a .1933 percent increase in GDP in the first period, a .0949 percent increase in the second period, and a .0574 percent increase in the last period, holding all other independent variables constant.

From the theoretical model, investment growth is expected to cause GDP growth to increase, which it does. Having investment growth increase by 1 percentage point, we expect GDP to increase by .1388 percent in period one, increase by .1294 percent in period two, and increase by .1507 percent in period three, holding all other independent variables constant.

Looking at the inflationary impacts, we predicted a rise in the inflation rate to cause GDP to rise during booms, which period two and period three mostly experienced. During supply shocks of the 1970s in period one, however, rising inflation was associated with decreasing

GDP, resulting in stagflation. During the other periods there was a standard inflation-GDP relationship, where inflation rises as GDP rises – the causality is pro-cyclical, thus we excluded inflation in the second and third periods from our regression model because GDP growth is *causing* inflation. This regression shows that a 1-percentage point increase in the inflation rate during supply shocks is expected to cause a .0721 percent decrease in GDP growth in the inflationary period prior to the Great Moderation, holding all other independent variables constant.

With inventories, theory predicts inventories to have an ambiguous effect on GDP growth. From theory, increases in inventories should cause an increase in GDP during expansions, but the presence of large stocks of inventories slows GDP growth during periods of slow growth. In this regression a 1-percentage point increase in inventories, for all the entire time series, is expected to have a .1538 percent increase on GDP growth, holding all other independent variables constant.

The labor force participation rates take two events into consideration: the period before the Great Moderation with low entry of baby boomers and women into the labor market, and the period of the Great Moderation and the period after, accounting for an increase of entrants into the labor markets by the baby boomers and women. The regression model gives a very pronounced effect, with a 1-percentage point increase in labor force participation rate in periods two and three expected to cause GDP to increase by .1020 percent, while only increasing GDP by .0071 percent in period one, holding all other independent variables constant.

The interest rate effects are demonstrated by the Volcker period occurring during the second period of the model, with the major impact of anti-inflationary policy, which had a detrimental effect on GDP growth. In 1979, while the federal funds rate stood historically high

at 10 percent, the rate was low by standards of the Volcker disinflation campaign (Goodfriend & King, 2004). Under Paul Volcker, Chairman of the Federal Reserve from 1979 to 1987, the period consisted of an increasing federal funds rate in an attempt to combat the stagflation crisis of the 1970s. The federal funds rate peaked at 20 percent by 1981. Subsequently, we expect a 1-percentage point increase in the interest rate to cause a .3094 increase in GDP in the first period, but a .0628 decrease in the second period, holding all other independent variables constant. Looking at the period after the Great Moderation, the regression model shows a 1-percentage point increase in interest rate is expected to cause a .0604 percent increase in GDP growth, holding all other independent variables constant, perhaps due to the reverse causal fact that rising levels of GDP lead to increases in money demand and high interest rates.

Considerations of the economic effects of the stock market are notable in the wealth effect, as an increase in the stock prices causes an increase in personal wealth, and consequently an increase in consumer spending, a component of GDP. Dow growth is also reflective of investor confidence. In this regression, Dow growth shows a much larger negative impact on GDP growth during the Great Recession era through the wealth effect and investor expectations effect than in the earlier periods. The regression model shows that a 1 percent increase in Dow growth is expected to cause a .0563 percent increase in GDP in period one, a .0078 percent decrease in period two, and a .0117 percent decrease in period three, holding all other independent variables constant.

3.8 Conclusion

The regression model for GDP growth provided empirical evidence of the theoretical determinants significant to economic growth. When the FIRE share grows relative to manufacturing, GDP tends to decrease significantly. The problem with the structural shift

towards FIRE and away from manufacturing is that that shift has a more pronounced and negative effect on GDP than when that same shift occurs with respect to services. In fact, with respect to services, when we have an increase in FIRE output relative to services, we have negative GDP growth in all three periods, with period three showing the largest adverse effect. Dow growth, reflective of the wealth effect, converts from having a positive effect on GDP growth in the first period to negatively increasing its adverse effect on GDP growth in the second and third periods. Mortgage debt growth exhibited similar behavior of decreasing its positive effect on GDP growth, having a strong impact in the first period and a much weaker relationship by the third period. Conversely, the regression model showed labor force participation having a very pronounced positive effect on GDP growth. We can further conclude productivity growth and investment growth as having a positive effect on GDP growth throughout the entire duration of the time series.

In the following chapter, a more comprehensive review of the statistical results is presented in order to evaluate key factors that led to the Great Recession and suggest recommendations regarding how GDP growth can be best stimulated in the years to come.

Chapter Four: Comprehensive Interpretation of the Empirical Analysis

4.1 Introduction

In reflecting on the economic prosperity attributed to the implemented policy and regulation during the Great Moderation, this study has presented the implications of factors that may have contributed to the instability of financial institutions – factors ascribed to the Great Recession era. During the Great Moderation, the existing system of stern financial regulation, Crotty (2009) explains, was deconstructed through radical deregulation advocated by financial institutions and justified by efficient financial market theory. The intertwining nature of an efficient financial system and economic growth allowed this study to explore the risk implications of growing mortgage debt levels, economic effects of the stock market, notable through wealth effects, technological improvements as a significant source of productivity growth, changes in the size of the capital stock, labor force participation as a determinant of potential GDP, the influence of the Federal Reserve over the supply of and demand for balances at Reserve Banks leading to control interest rates, and spillover effects that can lead to higher rates of growth in value added for other sectors. Taking further into consideration contributors to the current instability of the financial system were financial innovations that preceded instability during a trying economic period.

4.2 Summary of Findings and Recommendations

In order to present the key factors that led to the nation's most gripping financial crisis in the postwar period, we reflect the overall focus of the analysis during the period of the last recession. In addressing the effects of the finance industry on GDP growth, the regression results are employed to provide empirical evidence of determinants that are significant to economic growth.

Recall, the growth in the share of finance, insurance, and real estate (FIRE) generally leads to less growth in GDP, especially when it rises with respect to manufacturing. Manufacturing growth can be argued to be a better stimulus than FIRE, since manufacturing is a tangible good and FIRE is a financial service. Further, in terms of the value added growth model presented in the theoretical chapter, having a growing manufacturing share is more beneficial to GDP than a FIRE share, based on the empirical results, and the same can be said for services. In considering the linkages between contributors to the instability of the financial system, and further the economy, we must consider the relationship among FIRE output, service output, and GDP.

Consider the ratio of the output of FIRE relative to the output of services where FIRE has the ability to stimulate services attributed by the growth of FIRE due to financial innovations, which in turn would make services more productive. In this case, a rise in the ratio of FIRE output to the output of services would cause a rise in GDP growth. If FIRE output stimulated the output of services, then a growing FIRE sector, results in a rapid growth of services due to the linkage, a causal chain between the two outputs. One linkage is seen by the implication of an increase in FIRE, which would imply and increase in services, which implies an increase in GDP. Because FIRE is growing, FIRE is consequently stimulating GDP, and, FIRE stimulating services, indicates FIRE stimulating GDP even further. However, if the linkage is inverted, where an increase in FIRE output implied a decrease in services output, then this could imply a decrease in GDP. This may not necessarily be the case, as the positive impulse due to FIRE might overwhelm the negative impulse in services. This then begs the questions, does FIRE output tend to stimulate services output, which in turn contributes more to GDP, or does it have an adverse affect?

The negative coefficients reported by the regression model are the indication that the growth rate of FIRE, especially in period three, was having an adverse affect on the economy. As noted in the empirical analysis, the effect of FIRE output relative to service output in terms of GDP growth is much more pronounced in the Great Recession period. For the most part, as FIRE grows relative to manufacturing and services, it mostly has an adverse affect on GDP, all else constant.

The regression model results further suggest that the ratio of FIRE share relative to manufacturing share in periods one and three, and investment, inventories, and interest rates in the first period, are all significant in determining GDP growth. Conversely, the coefficients for the ratio of FIRE share relative to service share are insignificant in determining GDP growth. This is consistent with the theoretical expectations that changes in value added shares and disruptions that interfere with the ability of the financial sector to intermediate financial flows might therefore negatively affect economic growth. Further, the coefficients for mortgage debt growth, inflation in the first period, the labor force participation rate, interest rates in the second and third periods, and Dow growth in the second and third periods are also insignificant in determining GDP growth. Based on this evidence, the study makes use of the theoretical and empirical findings to address conceivable recommendations on how GDP growth can be best stimulated in the future.

When thinking of economic measurement and structural change, economic measurement works well during times of economic prosperity, as during the period of the Great Moderation. In the current economic climate, however, some of the issues to pay attention to in trying to quantify the health of the economy are consumption, and how consumers and businesses respond to optimistic reports on the employment front. Recall that businesses demand labor to meet the

needs of a growing economy; hence, as GDP grows, the unemployment rate typically falls. Equally, the reverse causal fact that rising levels of GDP lead to increases in money demand and high interest rates is indicated by the regression model with positive interest rate effects on GDP during the last recession. Further, an increase in a stronger and more efficient labor force is suggestive of firms feeling the need to respond by increasing their resources to meet their demand, which begs the questions, why has the economy not experienced a stronger recovery?

In terms of the economy as whole, the economy is recovering, the general trend is improving, but at most, it is a modest improvement. By way of technological improvements, productivity growth was one significant source in positively affecting GDP, as demonstrated by the regression model. In terms of employment outlook, recall the regression model showed labor force participation having a very pronounced positive effect on GDP growth. Speaking in terms of the consumer, stronger income growth due to a better employment outlook leads to higher consumption. However, the economy is not observing consumer confidence levels that are facilitating consumers to lower their savings rate. Consequently, the growth rate of consumption is unable to sustain a rapid rate of growth. Recall, economic effects of the stock market are notable in the wealth effect, as an increase in the stock prices causes an increase in personal wealth, and consequently an increase in consumer spending, and vice versa. The Dow growth variable demonstrated a much larger negative impact on GDP growth during the Great Recession era through the wealth effect and investor expectations effect than in the earlier periods.

Additionally, consumers are still constrained by the effects of the finance–mortgage crisis, with homes that are underwater or going into the foreclosure process, and therefore consumers have restricted their access to credit markets. Most importantly, the rest of the household sector now operates in a market with higher underwriting standards where access to

credit has diminished, as reflected by the insignificance of mortgage debt in determining GDP growth reported by the regression model. With a decrease in the availability of credit, households and firms may not adequately smooth out changes in spending over the course of ups and downs in the business cycle. Recall, mortgage debt growth exhibited a decreasing positive effect on GDP growth, having a strong impact in the first period and a much weaker relationship throughout the Great Recession. There is a fundamental issue about the degree of confidence businesses have about the environment they are operating in, both in terms of what the growth outlook is and in terms of policy, both of which can be argued to be factors that are holding the economy back. Regulatory changes without a doubt, Bernanke (2011) states, will continue to emphasize that the importance of maintaining financial stability is an equally important critical responsibility, among the consumer and firms.

Further, we must warn that the economy is still operating in a world where the constraints coming from disruptions in mortgage finance, the adjustments in the financial sector, the need to have expansionary fiscal policy, are all material headwinds on the recovery that are ongoing. New financial regulations, such as the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, represent significant change in today's financial regulatory environment since the prevalent regulatory change rising out of industry failure after the Great Depression.

The Dodd-Frank financial stability act aims to establish rigorous standards and regulation to protect the economy and consumers, investors, and businesses. To safeguard from unnoticed and unregulated financial innovations, Dodd-Frank eliminates loopholes that allowed risky and abusive practices among asset-backed securities, hedge funds, and mortgage brokers. Following Bernanke's argument that although financial innovation creates an enormous economic benefit that flow from a healthy and innovative financial sector, the need to enhance risk management

became the primary driving force behind financial innovations. As previously warned, contributing factors of market-driven financial innovation, such as securitization, contributed to the instability that ascended within financial institutions in recent years, and further added to economic uncertainty. Transparency and accountability of innovative financial instruments will be key in restoring the stability of the economy in the years to come. Additionally, to protect investors and businesses, transparency and accountability will rid the system of the influencing nature attributed to production processes such as credit scoring and credit ratings of financial institutions by credit rating agencies that led to the financial instability of those institutions. Moreover, the Volcker Rule, as implemented in the Dodd-Frank Act, requires regulators implement regulations for banks, their affiliates and holding companies, to prohibit proprietary trading – securities' transactions where the profit and losses are sustained by the banks, and not its customers. The Volcker Rule prohibits investment in and sponsorship of hedge funds and private equity funds, and limits the relationships with hedge funds and private equity funds.

Furthermore, the need for fiscal constraint to balance the budget calls for fiscal consolidation in the years to come. However, fiscal consolidation poses major assumptions on how government deficit issues are to be resolved, implying fiscal corrections must be administered. Fiscal consolidation, and how it is implemented will be a major factor. Obviously, a cyclical aspect of the economic state is suggestive of stronger growth generates stronger revenue. To this end, suggestive of the political climate are also indications that this nation is a on a path to fiscal consolidation, and the only question really is, how fast will this be occurring?

Along with fiscal consolidation, it is the hope that new financial regulations will help stabilize the economy as they did in the years following the Great Depression.

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