THE CHANGING DYNAMICS OF THE EMPLOYMENT GAP AND ITS MACROECONOMIC IMPLICATIONS

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Abstract

There has been much discussion about the sluggish economic recovery out of the recent recession. However, the lag in employment growth is not unique to the most recent recovery. Jobless recoveries have plagued the U.S. economy over the last three business cycles. The reasons for this change have remained largely inconclusive, with several factors highlighted in the current literature. This paper uses Vector Autoregression (VAR) to analyze the employment gap in the United States over the past six decades. Unlike previous studies, it accounts for the most recent recession while also addressing alternative explanations - trade and globalization, government employment, the housing market, and the sectoral mix of the U.S. economy – within the context of business cycle economic theory. This study finds evidence that performance in the housing and the import sectors, as well as the industrial mix of the economy have a significant impact on the size of the employment gap in the United States. To a lesser extent, it finds that fluctuations in government spending and productivity also influence the size of the employment gap.

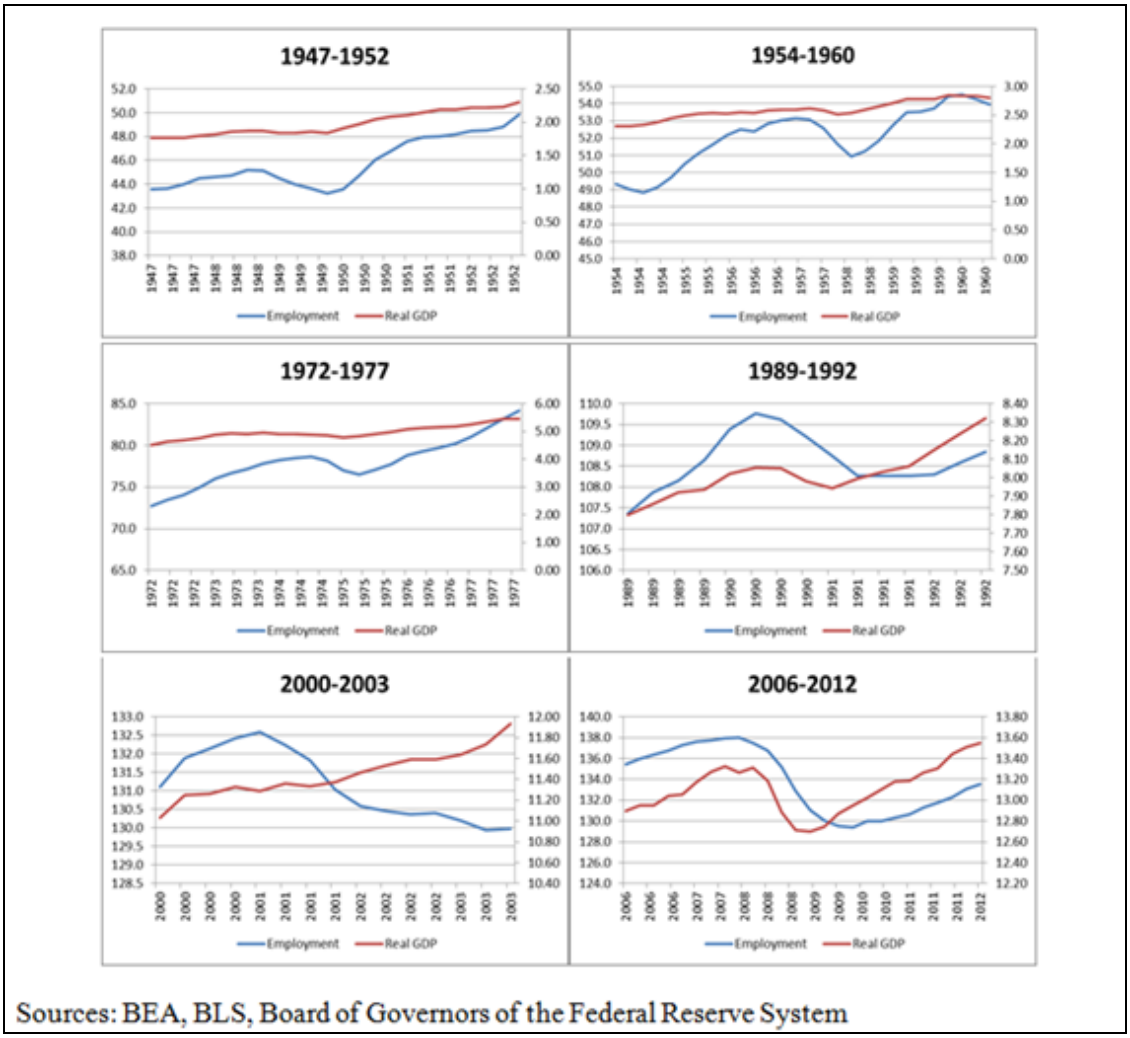
1. Introduction

Following business cycle contractions, economies have historically rebounded quickly, resulting in relatively rapid expansions that return the economy to its pre-recession levels of output and employment. This is evident in Figure 3 in section 3.1 of the paper, which shows an increase in the growth of employment during a recovery that is proportional to its decrease during the contraction. However, during the past three contractions in the United States, output has returned to its prior level, but employment and payrolls have lagged seriously behind. This phenomenon is known as a 'jobless recovery,' specifically defined as a recovery in which return to a pre-recession level of output is not closely followed by a return to the pre-recession level of employment in an economy. While it has not always been the case in the United States, there is growing evidence that the jobless recovery has become a permanent fixture in American business cycles, which potentially represents a structural change in the U.S. and global economy.

A very basic analysis of historical data plotting real GDP and total employment over the course of eleven business cycles shows that there is evidence of the existence of jobless recoveries, and there has been a sharp change in the recession-recovery dynamic during the past three contractions. This change is illustrated in Figure 1, where it is clearly visible that the last three recoveries in employment were much slower to develop compared to the first three. In fact, of the eleven business cycles examined between 1947 and 2012, the first eight were remarkably consistent in that employment returned to its pre-recession levels just three or four quarters after the trough of the recession. This trend came to halt during the 1992 recovery, when it took twice as long (eight quarters) for employment to bounce back. The resiliency of the labor market has only worsened over time. Following the 2001 recession, employment reached its pre-recession

peak 13 quarters after the lowest point in the contraction. Finally, in the most recent recession, employment has yet to fully recover after 12 quarters, and it remains 4.5 million jobs off its peak in 2008, according to numbers from the Bureau of Labor Statistics.

Figure 1: Selected Business Cycles, 1947-2012



Sources: BEA, BLS, Board of Governors of the Federal Reserve System

This paper examines the historical trends in U.S. economic recoveries and seeks to identify the underlying causes behind the recent shift to these jobless recoveries. A large historical analysis of economic trends is included in this paper in order to compare the

differences in the structure of the U.S. economy over time. A long-run analysis of the features of the U.S. economy provides the foundation for examining specific factors that may have caused jobless recoveries, and what the future effects of these recoveries could be. Inferences made about this phenomenon based on some fundamentals of economic theory, specifically the philosophies of John Maynard Keynes, Friedrich Hayek, and Joseph Schumpeter, indicate a range of potential causes including, but not limited to, the industrial mix of the U.S. economy (the ratio of goods production to services production), changes in productivity, changes in capital flows and investment, changes in corporate practices, and the forces of globalization. A literature review is conducted to understand the dynamics of jobless recoveries as explained by economists, to understand the relevant information that pertains to them, and to support the conclusions of this paper. With this current period being the third consecutive jobless recovery, there is now solid evidence that this is becoming a trend that must be explored in greater detail. This paper attempts to fill the gaps in the existing literature by testing the effects of variables that have largely been excluded or overlooked in previous analyses.

The paper specifically looks at the effects of the housing market (new housing starts and employment in construction industries), government employment, international trade, and the sectoral mix in the US economy as the means for understanding the jobless recovery dynamic. As is evident in the literature review below, these factors were minimally addressed in the existing literature, and thus will be the center of this unique analysis. In addition, potential policy proposals will be incorporated into the paper in light of the model's results, contributing further to this particular study's unique approach.

Quarterly data, dating from 1947 to 2012, has been gathered from major national databases that track economic activity related to production and the labor market. The Hodrick-Prescott filter is used to create the *employment gap* data series, which is tested to show the causes of these recent jobless recoveries, by separating the employment data series into its long-run trend and its short-run fluctuations as part of the general business cycle. This is econometrically tested as part of a Vector Autoregression model that accounts for the endogeneity of the variables given their interconnectedness in the activities of the economy at large.

2. Literature Review

The literature on the causes, effects, and dynamics of jobless economic recoveries reveals a number of existing theories trying to explain this phenomenon and suggests six primary factors as potential causes for the pattern of jobless recoveries observed in the United States over the past two decades. These factors include labor market dynamics (skills mismatches, the mix of labor, sectoral allocation, etc.), business practices, housing market dynamics, government employment levels, technological shifts and productivity, and trade and globalization. The literature review conducted in this study focuses on the analysis of these variables, and also addresses other theories and factors in order to ensure the paper is sufficiently comprehensive. This review first discusses the fundamentals and viewpoints of the major schools of thought in modern business cycle theory. Second, the review is divided into topic sections focusing on each of the six variables listed above. Finally, a general examination of the literature review provides the foundational support and reasoning for the factors that are to be included in this study in order to add to the existing literature.

2.1 Theories of the Business Cycle

There are two major philosophies of business cycles and the economics behind them: Keynesian economics and Austrian economics as outlined by Friedrich Hayek. In addition, Joseph Schumpeter's theories on creative destruction and capitalist development are included in this overview. Both Keynes and Hayek focus on the short-run dynamics of business cycles, particularly the relationship between supply and demand and the fluctuations in output and employment that result from this. As will be shown below, Keynes focuses on the demand portion of this equation, while Hayek and Austrian economics stress the role of supply portion. Contrary to both of these philosophies, Joseph Schumpeter has a broader scope when examining business cycles. His view of these economic fluctuations focuses less on supply and demand or monetary issues and more on innovation and productivity in the long run. For Schumpeter, business cycles are more a function of structural changes in the economy rather than cyclical ones.

i. Keynesianism

The primary focus of Keynesian economic theory is on aggregate demand and its relationship to production and inflation in an economy. In the short run, it is aggregate demand that determines the level of income, production, and prices in the economy. Aggregate demand itself is influenced by a whole host of factors that include private consumption, investment – more specifically changes in what Keynes defined as the "marginal propensity" to consume or to save – as well as government spending. For Keynes, the most important of these is the demand investment as determined by the expected rate of return on that investment and current interest rates. This process is evident in the basic Keynesian "transmission mechanism," which shows

that expectations, interest rates and, hence, investment ultimately drive the movement of the aggregate demand curve. One of the most important features of this model, however, is the recognition that changes in total demand have their greatest effect on output and employment as opposed to prices (Blinder, 2008).

The key to Keynes's theory is the belief that prices and wages are relatively rigid, or "sticky," in the short run. Because prices and wages are sticky and slowly respond to the changes in aggregate demand and aggregate supply, Keynesian theory recognizes that this often results in simultaneous and periodic shortages or surpluses in the labor market. This is particularly critical for this study, for Keynesianism assumes that there will be times of greater or less unemployment due to business cycle fluctuations. However, what we will see is that these current surpluses of labor have lasted longer than is to be expected, which Keynes would attribute to protracted weakness in aggregate demand caused by a lack of investment.

In terms of the components of the business cycle itself, Keynesian theory associates economic expansions with optimistic investment outlooks because the expected rate of return to investment is likely greater than the prevailing interest rate. Through the transmission mechanism, an increase in the supply of loanable funds should lead to decreases in interest rates and rises in investment, eventually leading to an increase in aggregate demand and an increase in production and income. During this period, there is a shortage in the quantity of available labor in the economy, and wages and prices ultimately rise as well. This process continues until a point is reached where, because of heightened demand for investment during the expansion, the supply of loanable funds becomes depleted, causing the interest rate to rise again and diminishing the returns to investment (Blinder, 2008). Higher interest rates also lead to greater amounts of

saving relative to spending (changes in the marginal propensities of consumption and saving). The decline in both consumption and investment lead to a decrease in aggregate demand, output, and income. Employment falls and eventually prices and wages decline as well during the recessionary period. This large process repeats itself, creating the long-run cycle of economic activity.

What is crucial for this analysis is the understanding that basic Keynesian philosophy hinges on changes to aggregate demand and investment. It is through this mechanism that Keynesian theory would explain a jobless recovery as well. Keynesian theory could first look to the changing demands within investment itself. For instance, a disposition towards capital investment over investments in labor would account for the return to growth in output coupled without similar growth in employment. A rearrangement of investment away from labor and towards capital would be one explanation for the changes in the dynamics of economic recoveries. In addition, Keynesianism might also say hiring, like prices and wages, may also be sticky. Within this context, wage stickiness would be the primary focus. Because wages take a long time to fall and adjust to economic downturns, it is much easier for firms to lay off workers than to alter wages. In that same way, because wages are inflexible, it becomes difficult to rehire individuals soon after because wages have not yet adjusted. Therefore, Keynesianism might also attribute a jobless recovery to an increase in the lag time for wages to adjust to broader changes in the economy. Essentially, wages have become stickier over time.

As with more usual fluctuations in the business cycle, Keynesianism believes that government should intervene through fiscal policy to counteract booms and busts in the economy. Keynesianism would call for expansionary fiscal policy during a jobless recovery for a few

reasons. First, government spending can offset the fall in private sector investment. More specifically, government often directs this spending toward labor-intensive projects like infrastructure and public works, which would be especially helpful during a period of a weak labor market and extended joblessness. In addition, other expansionary policies like tax cuts and unemployment insurance allow individuals to retain a portion of income, which can be directed into higher consumer spending and boost aggregate demand. These increases in investment and consumption would theoretically return the balance between labor and capital investment that would increase employment rolls and account for the increased rigidity in wages and hiring.

ii. Austrian Economics

While Keynesian theory focuses heavily on the demand-side of the economy, Austrian economics looks to the supply-side of the equation, particularly to the role of money and credit. Changes in the money supply and the supply of credit primarily lead to the cyclical fluctuations in the level of production and prices in an economy (Hayek, 1929). The most famous thinker in the "Austrian school" is Friedrich Hayek, whose extensive writings and explanations of these philosophies are used as the proxy for this business cycle theory.

Hayek clearly states that the primary cause of cyclical fluctuations are changes in the volume of money (or money supply), which eventually lead to a "falsification of the pricing process" and a "misdirection of production" (1929, p. 140). There are then three factors that affect the volume of money in circulation in the economy: changes in the volume of cash caused by the inflow and outflow of gold, changes in notes circulated by central banks, and the "creation" of deposits by banks through the practice of fractional reserve lending. Hayek emphasizes the role of the banking system in this process, noting that many fluctuations occur when the interest rate

demanded by banks is not equal to the equilibrium rate and is instead determined in the short run due to calculations of liquidity. This can happen because of an "elastic currency," whose volume is determined by the demands of businesses as opposed to being strictly controlled by the central bank. Hayek does recognize that this plays an important role in the business cycle, but it is not the only factor in the equation, as it is simply part of the modern organization of credit origination and economic activity. It is also important to understand that business cycles do not always have to be caused by *monetary mechanisms*, but rather that these monetary mechanisms are what cause changes in the *pricing process*. This runs counter to Keynesian theory, which asserts that changes to prices come about through changes in investment and aggregate demand.

The immediate consequence of these fluctuations in the money supply – as determined by the requirements and demands of business due to the elasticity of currency – is the failure of the "interest brake" to operate as quickly as it would in an economy without credit. In turn, as new adjustments are made on a larger scale than can normally be completed, a boom or expansion in production occurs; however, this is inevitably followed by a contractionary crisis (Hayek 1929, p. 179). In his later work, *Prices and Production* (1931), Hayek draws the connection between money supply variations and the production process. For Hayek, the pricing mechanism and the level of the money supply determine the "structures of production" in an economy, or the balance between consumers' goods and producers' goods (intermediate goods). This balance also depends on the production mix in an economy, or the assortment of land, labor, and capital available, but Hayek and Austrians place a particular emphasis on the role of capital. "The continuance of the existing degree of capitalistic organization depends, accordingly, on the prices

paid and obtained for the product of each stage of production and these prices are, therefore, a very real and important factor in determining the direction of production" (Hayek 1931, p. 49).

The oscillation between the structures of production are the result of changes in demand for either producers' or consumers' goods due to changes in savings and spending rates or changes in the quantity of funds at the disposal of entrepreneurs and business owners. Both of these are directly related to the volume of money, which Austrians believe must almost always be held constant. Expansions in the money supply (inflation) lead to declines in consumption by consumers who forgo previous consumption patterns because of increased competition from producers. "The use of a larger proportion of the means of production for the manufacture of intermediate products can only be brought about by a retrenchment of consumption" (Hayek 1931, p. 57). This "forced saving" on the part of consumers as a result of inflation "elongates the production process" (economic expansion) and makes it more capitalistic. However, this process must inevitably be shortened once normal patterns return and production is less capital-intensive, leading to economic contraction and depression. In summation, for Hayek and Austrian theorists, business cycle fluctuations are caused by changes in the production process as a result of changes to the money supply and the disruption of prices. Despite this, Hayek recognizes that this is price capitalist economies pay for the speed of economic development that is enabled through credit and financing beyond aggregate saving. He notes the benefits of this to technical progress and cautions against maintaining stable credit and a money supply absolutely. "Stability of the system would be obtained at the price of curbing economic progress" (Hayek 1929, p. 191).

Staying true to his fundamental theories, Hayek would likely attribute jobless recoveries to changes in the monetary system, specifically to changes in the money supply and to the price level. Hayek asserts that the *production mix* in the economy (the ratio of land, labor, and capital) is determined by the money supply and the pricing process. It follows that a jobless recovery would likely be caused by a change in the money supply that affects production in a way that biases economic activity away from labor and towards capital or land. In this way, Hayek's theories are similar to Keynes in that they both recognize that shifts away from labor in the production process are likely to lead to a jobless recovery. In addition, Austrian theory postulates that changes in the money supply can lead to expansions in consumption with a simultaneous reduction in business competition. This reduced competition due to fewer firms would create an excess supply due to reduced demands for labor. In essence, firms would be able to meet consumption demand while still employing fewer workers. Regardless of the specific dynamics, Hayek and Austrian theory support the notion that changes to the money supply would create distortions in the economy that would lead to jobless recoveries.

iii. Joseph Schumpeter

Another important thinker in terms of capitalist production and business cycles is Joseph Schumpeter, who focuses much more on the long-run implications of production cycles and the health of the macroeconomy. Schumpeter believes business cycles are ultimately a net benefit for the economy and society. For Schumpeter, capitalism is an evolutionary process, and this inherent dynamism is expressed through the business cycle, which "progressively raises the standard of life of the masses" (1950, p. 68). The "series of vicissitudes" each time strengthens the "stream of real income" that flows to society, though each time is preceded by economic

disturbances, lost wealth, and unemployment (p. 68). These short business cycles, which replace outdated process as and elements with new ones, continue in the long-run, resulting in periods of industrial revolution that "periodically reshape the existing structure of industry by introducing new methods of production" (p. 68). The rise and fall of prices, employment, interest rates, and production are all part of the capitalist mechanism for rejuvenating the production process.

This phenomenon of internal revolution and rejuvenation is what Schumpeter defines as "creative destruction" – the process of endogenous change that brings about new products, production methods, markets, and organizations. Creative destruction is the engine that drives capitalism forward in the long run and raises wealth, quality of life, and standard of living for society. Schumpeter reaffirms the importance of the business cycle to the economic health of society, stating that "any system, economic or other, that at every given point of time fully utilizes its possibilities to the best advantage may yet in the long run be inferior to a system that does so at no given point of time, because the latter's failure to do so may be a condition for the level or speed of long run performance" (1950, p. 83). Essentially, because capitalism rarely employs all of its resources most efficiently, there is a constant effort by economic players to improve quality and efficiency, which eventually leads to growth and progress in society.

The Schumpeterian explanation for a jobless recovery is the most straightforward of the three general theories of the business cycle. Schumpeter would explain jobless recoveries as a result of a long-run, structural change to the U.S. economy over the past twenty years. Specifically, Schumpeter would cite a fundamental shift in productivity by firms that has resulted in the need for fewer workers while maintaining similar production or even while expanding production. In addition, Schumpeterian theory may support the hypothesis that the wave of jobless recoveries is

a new "industrial revolution," which for the last two decades has been completely altering the means and methods of production. For Schumpeter, the jobless recovery is a short-run by-product of a long-term trend or change. As such, there is little policymakers can do to counteract such a structural shift in the same way as Keynes would look to stimulate investment or Hayek would advocate for a more stable money supply. In the Schumpeterian model, the phenomenon of a jobless recovery is something that must be accepted as part of a new economy that is in the end more efficient and productive.

Keeping the three above theories in mind, the following includes a review of the current literature on jobless recoveries and an examination of its most widely cited causes. This discussion links these explanations to those same thinkers in a way that informs the current debate and ultimately helps to paint a more complete picture of why jobless recoveries have become a trend in the U.S. economy in the last twenty years. These conclusions also help find the gaps in the theory and the current debate and attempt to fill them through this analysis.

2.2 Labor Market

Perhaps the most obvious explanation for the recent trend in jobless recoveries is that there have been drastic changes to the characteristics of the labor market, most of which are argued to be structural. Groshen and Potter (2003) outline this argument by asserting that structural changes have occurred in the labor market in two ways: there is now a "predominance of permanent job losses over temporary layoffs," and there has also been a relocation of jobs from some industries to others. Their analysis suggests that the jobs added during the 2001 recovery (the second jobless recovery, with 1991 and 2009 being the first and third respectively) have been "new positions in different firms and industries, not rehires" (2003, p.1). As a result, employment has

recovered slowly because it simply takes more time to create new jobs than it does to fill existing ones. They believe this dynamic to be structural rather than cyclical because of the inordinately long lag in employment growth compared to other recoveries. Groshen and Potter (2003) also point to job relocation as evidence of structural change, claiming that jobs have been shifted from some industries to others, but unlike previous recoveries, industries that shed jobs have not regained them. They cite data showing that "industries undergoing structural adjustments increased their share of total employment to 57 percent" in the 1990s and then a subsequent increase to 79 percent in 2001 (2003, p.4). Schreft et. al. (2005) also reference potential structural changes in the labor market, particularly in its flexibility. Citing diminished union participation, rising healthcare cost, and technological changes, the authors believe that the labor market has become more flexible since the first jobless recovery in 1991. For these reasons, it is not as costly to delay hiring, even when demand bounces back. This would explain a jobless recovery in that businesses are not faced with pressures to immediately resume hiring and can thus afford to increase production without increasing their workforce.

Despite the fact that some sort of labor market restructuring seems like a highly plausible cause of jobless recoveries, many are not so convinced. Freeman and Rogers (2005) find Groshen and Potter (2003) to be a flawed study, believing their methodology to be biased toward proving structural shifts. In addition, they reject the notion that there is no shift in the relocation of jobs among industries, citing the fact that employment in the wake of the 2001 recession was below trend in many private industries, not just technology. Freeman and Rogers (2005) outline many other factors that could be potential causes; however, they admit that they do not know which has the greatest causal relationship and that their study is rather incomplete. Aaronson, Rissman,

and Sullivan (2004) also reject the hypothesis of sectoral reallocation, explicitly citing Groshen and Potter's (2003) poor proxy measure of reallocation. Instead, they find another measure from a previous study that disproves uniqueness in sectoral reallocation during the recoveries of 1991 and 2001. Cotti and Drewianka (2007) also agree that the inefficiencies in the labor market following the recessions of 1991 and 2001 are not linked to structural changes, thus rebuffing the sectoral reallocation theory. In their study, they focus on the Sectoral Shift Hypothesis, which postulates that labor markets clear more slowly during times of structural economic change, and use Beveridge curve analyses to state their case. The analysis shows no increase in market inefficiency during the 1991 and 2001 recoveries, concluding again that structural labor market changes are not a major factor in the recent jobless recoveries.

Gali, Smets, and Wouters (2012) dismiss the idea of the "jobless recovery" entirely, instead labeling them "slow recoveries." They propose that changes to risk premium and investment shocks, especially in the 2001 and 2009 recessions, altered the traditional course of recovery. They note that the three previous recessions saw output declines much greater than in previous recessions, thus the expected recovery should be longer. Koenders and Rogerson (2005) echo this with their assertion that business cycle dynamics have changed as a result of longer expansions leading up to the contractions. Faberman (2012) looks to the new characteristics of the Great Moderation as an important factor in this change. He believes that aggregate shocks are now notably different from the past. These shocks are larger and more persistent, and therefore, labor adjustments will take much more time to return to normal. Critically, job destruction is particularly sensitive to this dynamic. Engemann and Owyang (2010) support something similar. Recognizing the effects of the Great Moderation, they stipulate that there has

now been a slowdown in the "speed of transition" between peaks and troughs in the business cycle, which leads to anemic employment recoveries.

Reverting back to the three basic philosophies, Schumpeter's theories emphasizing structural change are most closely aligned with the above explanations, especially that of Groshen and Potter (2003). Keynes and Hayek both would seem to support the sectoral reallocation theory of jobs moving away from some industries and towards others. Each would argue that this relocation would be skewed away from labor-intensive production and investment. However, they would stipulate that this is only a short-run fluctuation and it will eventually return to a more balanced ratio. The short-run fluctuation hypothesis runs counter to Groshen and Potter (2003) and to Schumpeter as well given that each supports the notion that this is structural change in the economy.

2.3 Business Practices

Another major explanatory supposition is that corporate practices and organizational management have changed recently, contributing to the slow growth of employment in the last few recoveries. Schreft and Singh (2003) are the strongest proponents for the theory that basic changes to business hiring practices have caused the latest sluggish recoveries. Noting the increasing flexibility in the labor market, they posit that firms have turned to "just-in-time employment" practices in order to cope with demand fluctuations, especially demand increases. As mentioned above, Schreft et al. (2005) stress the new, more flexible labor market and its causes. Schreft and Singh (2003) note that this practice is particularly evident in the production sector, which contracted by an average of 2.9 percent in the 1991 and 2001 recoveries, while it expanded by an average of 3.1 percent in previous recoveries. The service sector has shown

comparatively anemic growth as well, supporting the conclusion that this is not just a sectoral problem. Additionally, they use Okun's law to show that employment actually grew more slowly than can be explained by the sluggish GDP growth that has occurred simultaneously. Keynesian theory would support this logic as well, noting that shifts in output are accompanied simultaneously by similar changes to the means of production. Because the changes in employment and output do not match up with Okun's law, Keynesian theory would reinforce the notion that something deeper has changed within the economy. They note the increase in overtime hours as evidence that companies are forcing employees to work longer, as opposed to hiring more workers. Schreft et al. (2005) dub this phenomenon the "wait-and-see" hypothesis, because firms are more willing to watch rather than act in the labor market, especially given the ostensible increases in overall flexibility.

Groshen and Potter (2003) list many of these as significant factors as well. Aaronson, Rissman, and Sullivan (2004) also agree that the recent predisposition to just-in-time hiring practices is contributing to poor employment growth during recent recoveries. They point to the growth in the temporary services and consulting industries. Aaronson, Rissman, and Sullivan (2004) along with Freeman and Rogers (2005) both note the effect of increasing health insurance costs on employment, believing that these costs contribute to the growing tendency of firms to hire more temporary workers in order to reduce this potential cost. These ideas can all be linked to the general assumption of wage rigidity as outlined by Keynes, but here hiring practices have become more rigid as well because of changes to the behavior of firms.

Koenders and Rogerson (2005) propose that organizational restructuring has undergone changes that have caused jobless recoveries, particularly within the context of the Great Moderation.

They recognize that the 1991 and 2001 recoveries were preceded by unusually long expansions. Assuming that firms use contractions – when productivity is particularly low – to correct for inefficiencies in labor, it follows that firms would take longer to correct for these inefficiencies, thereby leading to extended periods of sluggish employment recovery. They note that business cycle dynamics become different after long expansions, explaining the uncharacteristic nature of employment growth during these two periods. This hypothesis is most closely aligned with the Schumpeterian model in that it accounts for the business cycle as a means of eliminating inefficiencies within the economy and as a component of a longer economic cycle itself. In this instance, jobless recoveries are simply the function of those inefficiencies and a structural change in the economy, notably the particularly long economic expansions cited by Koenders and Rogerson (2005) that have become the new normal in the long run.

2.4 Productivity and Technological Change

Productivity is one of the most basic explanatory variables for changes in the employment rate. However, there is a mixed reaction to this explanation of jobless recoveries. Groshen and Potter (2003) state that the "divergent paths of output and employment in the 1991-92 and 2002-03 suggest the emergence of a new kind of recovery, one driven by mostly productivity increases rather than payroll gains" (p. 2). Schumpeterian theory would support this assertion as well, noting that contractions are periods where inefficiencies are removed from the production process. In this case, Schumpeter would argue that the inefficiencies were in the labor portion of production, resulting in their elimination during the recovery period and causing it to be jobless. This creative destruction leads to efficiency gains that ultimately benefit the economy in the long run. The models produced by Sawtelle (2007) show that in 11 of 15 industries analyzed, capital

was determined to be a substitute for labor as opposed to a complement, thus likely leading to slower job creation during periods of organizational restructuring. Aaronson, Rissman, and Sullivan (2004) straddle the fence on the effects of productivity. They note that productivity grew very fast coming out of the 2001 recession and that it has the potential to be the cause of the weak employment growth. However, they stipulate that the productivity growth owes more to the "ebbing of adjustment costs" rather than breakthroughs in technology (2004, p. 16).

On the contrary, Freeman and Rodgers (2005) outright reject the notion of changes to productivity as a circular argument and because it appears to violate the theory that productivity would expand aggregate supply and thus permit employment growth to fulfill potential output. Gali, Smets, and Wouters (2012) also do not support the productivity explanation because their data show that GDP growth has also declined with employment growth. Essentially, there is really nothing to make up the difference between the growth in employment and the growth in output because they have both been sluggish simultaneously. Schreft et. al. (2005) believes that productivity falls short of explaining this phenomenon because it can only explain the slow job growth in the 2001 recovery, not the 1991 recovery. Finally, in a major paper about productivity-led growth post-1991, Gordon (1993) asserts that productivity growth only implies jobless recoveries in the very short term, not over drawn out periods like the years following the 1991 recession. He is skeptical of the view that there is a new era of productivity-led economic growth that will crowd out employment growth concurrently.

2.5 Trade and Globalization

Trade was mentioned as only a minor factor in the jobless recovery trend. Freeman and Rogers (2005) note that the trade deficit is at historic highs, but he does not believe that trade can fully

explain the slow employment growth over the last twenty years. They note the drop in FDI into the United States as a potential international contributor to these slow recoveries. Aaronson, Rissman, and Sullivan (2004) also recognize the potential effects of international markets, especially the rising trend in outsourcing and offshoring. However, they dismiss this as a mitigating factor because it "underestimates the ability of [the U.S. economy] to adjust to changing circumstances." (2004, p. 10)

As a primary factor of aggregate demand, Keynes would find the role of trade to be another factor that could potentially contribute to a jobless recovery, specifically a large ratio of imports to exports. This would likely lead to a decline in investment in production at home, reducing domestic output and the demand for labor. Given that this production, particularly in manufacturing of goods, was often a key driver of employment in the U.S. economy in earlier decades, a decline in exports would likely lead to decreases in employment as well. Like many other factors, the investments made in the production process have become skewed away from labor. Keynes would cite the drop in FDI as a contributing factor as well. Schumpeter's theories would also reinforce the importance of changing trade patterns as an explanation of jobless recoveries. More specifically, the shift in production out of the United States and boom in imports relative to exports is a structural change that has affected the U.S. economy for the last two decades. Schumpeterian philosophy would argue that the forces of globalization have fundamentally altered the means of production in the United States.

2.6 Housing and Construction

While the topics listed above were discussed extensively in the current literature, two components, housing and construction, were scarcely mentioned. Sawtelle (2007) shows that the

housing investments and construction are highly elastic to changes in GDP, thus they are likely to have significant effects on business cycle fluctuations. Cotti and Drewianka (2007) show that housing and construction is highly inefficient in the labor market in the short-term as well, which would explain its role in contributing to the jobless recovery specifically. Its high level of inefficiency would lead to extensive job losses even if residential investment began to recover, also adding to the effects of a jobless recovery. Although this logic does theoretically support the notion of a jobless recovery, this factor was not seriously considered in the bulk of the current literature, thus making its role largely inconclusive.

Keynesian theory would support the importance of housing and construction to jobless recoveries given their role in aggregate investment in the economy. In addition, because it is labor-inefficient, the drop in investment in this sector would significantly reduce total employment and also skew total investment away from more labor-intensive production to more capital-intensive production.

2.7 Government

Like housing and construction, the role of government spending and employment was given a cursory mention in the current literature. Only Freeman and Rogers (2005) note that government employment had significantly in 2001, making it a potential explanation for the large gap between output and employment during this period. Keynesian theory would support the lack of government spending and the drop in its payrolls as potential evidence for a jobless recovery. Again, much of the production the government provides is labor-intensive as opposed to capital-intensive. A large drop in employment may occur without the simultaneous drop in output given

the many demands already placed on government, which is generally slow to respond to broader changes in the economy and society.

2.8 Key Takeaways

The existing literature reveals a number of key insights on jobless recoveries and the employment gap. First, changes in labor markets and their operation, in productivity, and in the behavior of firms appear to be primary explanations for the recent changes to the employment gap and jobless recoveries among studies that have analyzed this issue. These conclusions also appear to have the greatest theoretical support among the three major philosophies outlined in this work. Keynes, Hayek, and Schumpeter all, in some way, reasonably account for these explanations, and jobless recoveries themselves, within their own models. However, their theories appear weaker when attempting to account for other possible factors that have been raised in recent studies, namely the effects of trade and globalization, housing investments and construction, and government spending and employment. On the whole, it appears that Keynesianism and Schumpeterian theory are the most suitable for explaining all of the relevant factors in these analyses. Austrian economics often falls short because many of these factors are difficult explain through changes in the money supply and the dynamics of the monetary system. Most factors are much more strongly supported by changes to the demand-side of the economy rather than the supply-side. In addition, there has been extensive support for the structural hypothesis, given that these jobless recoveries happened so suddenly and has now remained consistent over the past three business cycles, which lends greater credibility to the long-run theories of Schumpeter. That being said, no single school of thought can explicitly account for the shift to jobless recoveries in recent years. While Keynesianism may be able to explain it in

the short run, it does not account for its existence over the long run. In contrast, Schumpeterian theory does exactly the opposite: it fails to explain why it would occur initially in the short run, only citing a change in broad economic efficiency and the means of production. It does little to help us understand the process by which jobless recoveries ultimately occur.

This short-run analysis incorporates key variables of labor and productivity into the model in order to account for the consensus explanations among economists. In addition, it explores in more depth topics that were given only a cursory look in previous studies, specifically trade and globalization, housing and construction, and the role of government. Trade and globalization were discussed briefly in a couple of studies, but the growing forces of globalization and trade's increasing importance in total U.S. GDP merit a greater focus in this study. In addition, accounting for this may reveal the influence of globalization as a structural change.

As mentioned before, housing investments and construction are highly elastic to changes in GDP and can thereby have a disproportionately large effect on other areas of the economy. Therefore, it should be examined in the new model. This is especially so given the significant impact of housing investments and construction in the latest recession and recovery. Also, housing and construction is highly inefficient in the labor market in the short-term as well, which would be a useful explanatory factor because it has been one of the slowest industries to recover. The combination of high labor inefficiency and its disproportionate effect on the broader economy supports its inclusion into this analysis. Second, the drops in government employment in both 2001 and 2009 illustrate the potential importance of this factor, which would also be able to highlight a shift in the political economy of the United States over at least the last decade. This

may lend further weight to the structural shift hypothesis. The inclusion of these three factors is a clear contribution to the existing literature on jobless recoveries.

Another way in which this analysis will differ from the existing literature is that it will be a strictly quantitative analysis. Many of the prior studies were qualitative, and even if they were quantitative in nature, they lacked the rigorous econometric testing that will be the foundation for this analysis. Finally, there has been little published regarding the most recent jobless recovery, so this study is critical for including the dynamics of the Great Recession into new models of jobless recovery. This is an additional contribution to the existing literature that attempts to draw conclusions over a longer period of analysis, adding weight to the most recent and up-to-date study.

3. Data and Methodology

3.1 Data

This study analyzes data from 1947-2012 from different sources gathered through the Federal Reserve System. Employment is defined as total nonfarm payroll employment measured in thousands of persons by the Bureau of Labor Statistics (BLS) in the U.S. Department of Labor. The Hodrick-Prescott Filter, described in detail in the section below, was applied to this series to create the employment gap that serves as the key variable of interest in the model. To create a more precise specification, the employment gap variable needs to account for the size of total employment. Because we are attempting to explain jobless recoveries, the relative size of the employment gap is what matters, given that it appears to have expanded over time. In essence, we want to observe and test the size of the employment gap compared to the overall employment

pool. For example, an employment gap of 200,000 people in an economy with 40 million workers is dramatically different from the same gap in an economy with 140 million workers. To adjust for the growth in total employment, we simply calculated the employment gap as a share of total employment. Therefore, we will be able to test against the change in the nature of the employment gap over the last six decades.

Productivity is defined as output per hour for all persons as measured by the BLS. However, it is not a stationary data series itself. To adjust for non-stationarity, we took the *first difference*, or the change in productivity each quarter. There are two key government data series in this model. First is total government employment as a share of total nonfarm payroll employment, measured in thousands of persons by the BLS. Second is real government expenditures as a share of real GDP measured in billions of chained 2005 U.S. dollars. The housing data series include real private residential fixed investment per capita measured in billions of chained 2005 U.S. dollars by the BEA, adjusted for the total U.S. population, total new privately owned housing units started[1], or simply housing starts, measured in thousands of units also by the BEA, and total employment in the construction sector as a share of total nonfarm employment measured in thousands of persons by the BLS. Trade is split into its two basic categories: exports as a share of real GDP and imports as a share of real GDP. The industrial structure, or sectoral mix (these terms will be used interchangeable throughout the paper), is defined as employment in service industries as a percentage of total nonfarm employment as measured by the BLS. One caveat

[1] An augmented Dickey-Fuller test was conducted for this variable, finding it to be stationary, contrary to many of the other variables in this analysis. For this reason, it was not adjusted for population size. Many other variables were converted into a share of GDP/total employment because they did not pass the test for stationarity, and thus had to be manipulated in such a way.

that should be noted is that the timeframe for each data series is not consistent, meaning that some data series date back further than others. For example, many of the employment series and real GDP extend to 1948, but the some of the housing series begin in 1959. In addition, each data

Table 1: Summary of Variables

Name	Varname	Definition	Measurement	Source
Employment	Payems	Total nonfarm payroll employment	Thousands of Persons	Bureau of Labor Statistics
Employment Gap	EmpGap	Difference between actual level of employment & the trend in employment (1947-2012)	Thousands of Persons	
Adjusted Employment Gap	REmpGap	EmpGap/Payems, used to control for the size of the employment pool	Percentage	
Output	RGDP	Real GDP	Billions of 2005 chained U.S. Dollars	Bureau of Economic Analysis
Government Employment	GovPCT	Total government employment as a share of total nonfarm employment	Percentage	Bureau of Labor Statistics
Government Spending	ExpGDP	Government expenditures as a share of real GDP	Percentage	Bureau of Economic Analysis
Residential Investment	ResInvcap	Real private residential fixed investment per capita	Billions of 2005 chained U.S. Dollars	Bureau Economic Analysis/U.S. Census Bureau
Housing Starts	HStart	New privately owned housing units started	Thousands of Units	Bureau of Economic Analysis
Construction Employment	ConstrPCT	Total construction employment as a share of total nonfarm employment	Percentage	Bureau of Labor Statistics
Exports	ExptGDP	Real exports as a share of real GDP	Percentage	Bureau of Economic Analysis
Imports	ImpGDP	Real imports as a share of real GDP	Percentage	Bureau of Economic Analysis
Sectoral Mix	ServPCT	Employment in service industries as a share of total nonfarm employment	Percentage	Bureau of Labor Statistics
Productivity	DProd	Change in output per hour for all persons each quarter	Indexed: 2005=100	Bureau of Labor Statistics

series has been aggregated on a quarterly basis. A summary of descriptive statistics of the primary variables used in the analysis is outlined below. There are a few interesting findings in this table. First, we can see that the average employment gap, and adjusted employment gap, is statistically equal to zero. In essence, we can see that the size of both the labor market expansion and contraction in the business cycle are roughly equal during the business cycle. In addition, the slightly positive mean of the employment gap shows slight growth above the trend overtime, accounting for the general growth in the size of the labor market over the past several decades.

Table 2: Summary of Descriptive Statistics

Variable*	Obs	Mean	Std. Dev.	Min	Max
Total Employment	264	89261.730	31401.320	43237.000	137935.000
Employment Gap	264	0.000	1301.001	-3525.766	3341.563
Real GDP	264	6602.408	3722.897	1766.500	13652.500
Housing Starts	216	1467.259	392.599	526.000	2424.000
Government Employment	264	0.164	0.151	0.126	0.193
Government Spending	264	0.249	0.050	0.180	0.370
Residential Investment	72	0.002	0.000	0.001	0.003
Construction Employment	264	0.050	0.004	0.042	0.060
Exports	264	0.063	0.032	0.025	0.136
Imports	264	0.080	0.045	0.026	0.168
Services Employment	264	0.731	0.081	0.605	0.865
Productivity	263	0.322	0.519	-0.900	2.200
Adj. Employment Gap	264	0.000	0.015	-0.052	0.026

*See Table 1 for full description of variables

Also of note are the minimum and maximum values of the employment gap. They are almost polar opposites as well, further highlighting the consistency of the booms and bust in the business cycle. According to this data, the economy appears to do a fairly good job correcting for market imbalances and deviations from the market equilibrium.

3.2 Hodrick-Prescott Filter

This section of the paper applies the Hodrick-Prescott (HP) Filter to decompose the employment variable into two components: a long-run trend and the short-term fluctuations or deviations from that long-run trend. This approach allows us to develop the variable of interest for the econometric model discussed in the next section of the paper. More precisely, the difference between the actual level of employment at any given time and what the level *should be* based on its long-run trend yields the "employment gap" at that particular time. Deducing the trend from the actual data is a complex and slightly problematic process. However, time-series econometrics offers a key tool that allows this to be done: the Hodrick-Prescott (HP) Filter.

The HP Filter decomposes time-series data y_t into a long-term trend z_t and a stationary cycle μ_t through a more complex "sum of squares" formula (Enders, 2004, p. 224):

$$Y_t = z_t + u_t$$

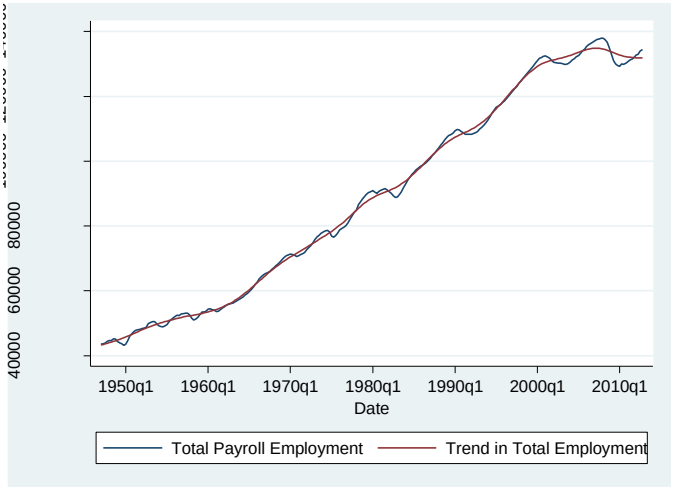
This filter creates the employment gap data that is critical to this analysis in essentially one step. In the equation above, the gap is represented by u_t, also defined as the short-run fluctuation in the data being analyzed. The other component, z_t, represents the long-run trend that is mathematically derived by the HP Filter application. Based on the sum of squares philosophy, the HP Filter forces the change in the trend to be as small as possible, and thus more precise. The major benefit of using this tool is that it uses the same method to extract the trend regardless of the type of variable; therefore, it can be used on multiple sets of data and yields consistent results across the overall analysis. However, we must be cautious of the inclusion of spurious fluctuations into the model because of the filter's function to smooth the trend. In essence,

because the data itself is non-stationary and has a highly visible trend even before the filter is applied, we must take care to avoid this trend from distorting the results.

The HP Filter is a linear filter that hinges on a constant parameter known as lambda, λ. This parameter depends on the periodicity of both the aggregate data and the primary period of the cycle that is being analyzed (Maravall & del Rio, 2001). The parameter determines the "smoothness" of the trend and reflects the "cost" to the analysis of incorporating cyclical fluctuations into the overall trend. As λ increases, the change in the trend becomes more constant, resulting in a linear time trend. Conversely, when λ=0, the sum of squares is minimized when $y_t = z_t$, or that the trend is equal to the actual values in the dataset. For quarterly data (the kind that will be used in this model), there is a consensus in the field on the use of 1600 as the value for λ, which implies a total period of approximately 40 quarters, or 10 years. This value was originally proposed by Hodrick and Prescott and has been adopted by organizations like the European Central Bank and the OECD, as well as other economists (Maravall & del Rio, 2001). It has proven to be very useful in these various instances, and it has remained the default industry standard in quantitative economic analysis. For these reasons, this value will also be used in this study.

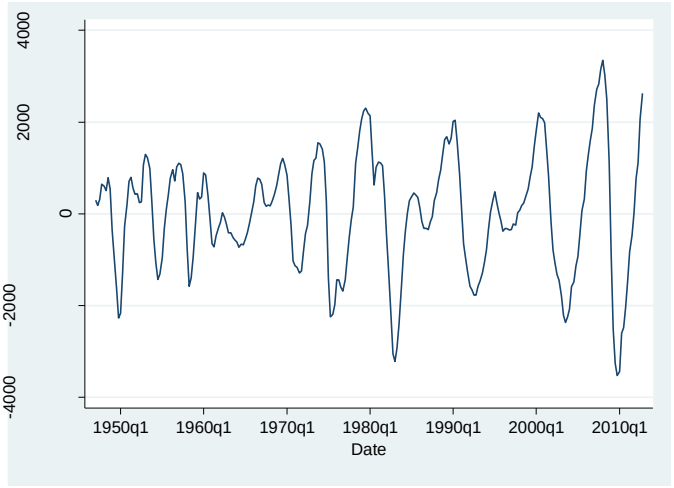
Applying the HP Filter to the employment series yields the trend in the level of total payroll employment in the U.S. economy from 1947-2012, as indicated by the red line in Figure 2. The critical component of this graph is the visible space between the red trend line and the actual level of employment as indicated by the blue line. These are the "employment gaps" that are created as a result of the business cycle. The points in which the blue line is above the red line indicate periods of economic expansion, while the reverse denoted periods of economic

Figure 2: Trend in Total Payroll Employment



contraction. These gaps have been plotted separately in Figure 3. This graph denotes the size of the employment gap over the same time period. This new data series, created by simply subtracting employment from the trend number as produced by the filter at each time interval, is

Figure 3: Employment Gap

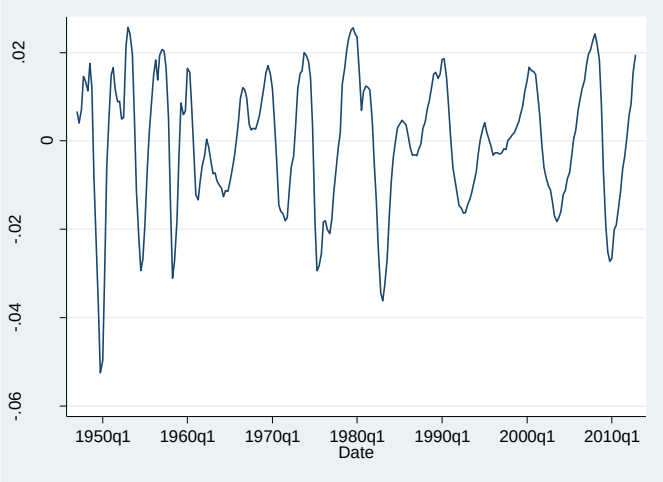


the variable to be tested in the econometric model. The purpose of this analysis is ultimately to explain these variances, particularly the last three negative gaps, which have been hypothesized by many economists to be jobless recoveries.

Examining the employment gap graph by itself yields some insights in its own right that should be pointed out here. Looking at the pattern of the fluctuations around the zero-level (in theory this point would be an equilibrium where the economy is at full employment and potential output), we notice that they have become both larger and increasingly spaced out over time. Basic knowledge of economics would imply that the increasing amplitude of these fluctuations denotes both larger economic expansions and contractions. Essentially, the intensity of the business cycle has increased over the past six decades in the United States. The spacing between each business cycle is consistent with this phenomenon as well. In the earlier portion of the time series, the cyclical fluctuations were much smaller yet much more frequent, but they have become larger and more spread apart in last twenty years. This is consistent with the understanding that larger economic expansions will be followed by proportional economic contractions. However, these results run counter to the recent hypothesis known as the Great Moderation, an economic theory citing a decrease in the volatility of the business cycle in the U.S. economy. The graph above shows that, even though there have been fewer business cycles, their intensity has only grown over time, especially in the last two decades.

An "adjusted employment gap" (notated as REmpGap in the data tables) variable was created to account for the size of the labor market and its growth over time, yielding a more precise specification of the employment gap and its relative impact on labor and the economy as a whole. The adjusted employment gap is graphed in Figure 4. The graph seems to actually be the inverse of the original employment gap plotted in Figure 3, with much larger fluctuations occurring in earlier cycles as opposed to the most recent ones. The spacing between the cycles does appear consistent in both graphs, with the ostensible expanding of the duration of the business cycle

Figure 4: Adjusted Employment Gap



visible in both graphs. The noticeable difference in the intensity of the cyclical fluctuations in Figure 3 is arguably non-existent in Figure 4, showing that there might be little evidence of any significant change in the labor market and the business cycle over these past few decades. Therefore, when controlling for the size of the labor market, there is little support for the theory of variations in employment dynamics in boom-bust cycle over the past 60 years.

3.3 VAR Analysis

Given the nature of the variables in this dataset, the standard OLS estimation techniques are not applicable because of concerns of endogeneity. This means that both the variable of interest and the other related variables are simultaneously determined within the model. A basic understanding of economics and the AD-AS framework can explain this. For example, employment, and thus the employment gap, is influenced by a myriad of factors which can include output (GDP), spending, investment, etc. In addition, GDP itself is a result of factors like government spending, exports and imports, and residential investment. In effect, these

factors are all determined simultaneously in an economy through basic economic activity. We can address endogeneity by employing vector autoregression analysis, or VAR.

The primary way in which a VAR system accounts for endogeneity is by incorporating feedback from each variable into the overall model (Enders, 2004). Essentially, this feedback is the lag effect that a particular factor has on another variable in the model, which represents the relationship among the variables over time. A simple example would be the relationship between output and employment. It is widely accepted that changes in employment lag behind changes in output. Therefore, it would be assumed that a change in GDP in the past would have an effect on the level of employment right now. This paper will use a standard VAR model, but to do so we need to choose an appropriate lag length for the model. An example of the equation of a two-variable VAR is written as:

$$y_t = \alpha_{10} - \alpha_{12} z_t + \gamma_{11} y_{t-n} + \gamma_{12} z_{t-n} + \varepsilon_{yt}$$

$$z_t = \alpha_{20} - \alpha_{21} y_t + \gamma_{21} y_{t-n} + \gamma_{22} z_{t-n} + \varepsilon_{yt}$$

This example also includes two lags for the sake of understanding the system; however, the actual model used in this analysis contains many more variables as well as additional lags. The process by which this was determined is described in the next paragraph.

In order to obtain the lag-order selection criteria for this model, we observe results from the Akaike Information Criterion (AIC) and the Schwarz-Bayesian Information Criterion (SBIC) estimations. Each of these selection tools yields the optimal lag time to be used in the overall VAR estimation. After running the analysis back to 1948, the AIC yields a lag of three quarters, based on the data aggregation, and the SBIC yields a lag of two quarters. A lag time of three was

selected because an increased lag time creates a more flexible VAR model, which is more desirable and beneficial.

Here, both *y* and *z* are variables within the model and are affected by each other in the model as well as exogenous shocks to the entire system. In the equations above, α_{12} is the contemporaneous effect of a unit change in z_t on y_t. For $\alpha_{21,}$ it is the reverse; it is the contemporaneous effect of y_t on z_t. The third and fourth terms in each equation are the lagged effect at time *n* of a unit change in y_{t-n} and z_{t-n}, respectively. Finally, ε_{yt} is the shocks that also affect the system of equations, but exogenously.

Like ordinary OLS estimations, concerns of stationarity and non-stationarity matter for time-series VAR estimations as well. All of the relevant variables have been converted into stationary variables, by taking either the first difference of the variable in the time series or by using proportions, which are by definition stationary variables.

3.4 Impulse Response Function

Because each factor within the model is connected and related to the others, we attempt to isolate the causal factors and the primary variable in question in order to understand the connection between them. This can be done through the impulse response function (IRF) technique. Essentially, this tool applies a shock to one of the causal variables in the model to uncover its effects on the variable of interest. The function reveals a relationship between the two variables as shown by the size of the shock, as well as highlighting a lag between the shock and the effect and the duration of that effect. Mathematically, the IRF model can be written as follows,

$$x_t = \mu + \sum \varphi_i \varepsilon_{t-i}$$

where x_t is the variable of interest and ε_{t-i} is the shock to the causal variable summed over a defined lag time. In this case, the shock will be applied to a variable like exports or imports, productivity, or government spending and the IRF will separately determine and record the impact of each on the employment gap. The outcomes of this test will be discussed later in the results section of the paper, along with the VAR estimations, given that results of the IRF lie at the core of this analysis.

4. Results

The process of developing the best fitting and most precise model included numerous revisions and multiple tests of varying combinations of our key factors. It was often the case that multiple variables represented one specific factor (i.e. housing was accounted for by both housing starts and residential investment), thus one was selected based on its level of significance within this first model. As a proxy for the role of government, government spending was selected over government employment, and as a proxy for the housing sector, housing starts per capita was chosen over employment in construction. After removing these variables, the regressed model yields the estimates in Table 3.

In the first equation, which examines the original model that was developed to explain jobless recoveries specifically, it appears that government spending is significant at 10% confidence level. Housing starts are significant during the first lag, but its influence appears to wane over during the lag time. Exports do not appear to be very significant while, conversely, imports are largely significant at the 5% level. The sectoral mix of the economy, specifically, the ratio of services to goods production is somewhat significant, as is productivity. While some of the variables are significant, the model as a whole does not seem to conclusively explain the shift to

jobless recoveries. Despite this, the raw data does still show a drastic difference in the business cycle dynamics beginning in 1990. We included a dummy variable, *Break*, to incorporate this sudden shift into the model itself. The dummy separates the data into two groups: 1947-1989 and1990-2012, coinciding with the changes in the original data. It is an exogenous variable, thus it was specifically set apart in the VAR model. The Break variable is significant at about the 10% level. This is an attempt to quantify any structural change that could have occurred during this period as well, which is difficult to both define and measure in an analysis of this type.

Table 3: VAR Estimations (continues)

	(1) Baseline Model	(2) Break 1970	(3) Break 1980	(4) Estimation 4	(5) Estimation 5	(6) Estimation 6	(7) Full Model
REmpGap							
L.Government Spending as Share of GDP (%)	-0.00358	-0.0441	-0.0149	-0.0855*	-0.0713	-0.0445	-0.0387
	[-0.08]	[-0.96]	[-0.34]	[-1.94]	[-1.59]	[-0.96]	[-0.85]
L2.Government Spending as Share of GDP (%)	0.107*	0.0945*	0.101*	0.104*	0.109**	0.105*	0.101*
	[1.96]	[1.74]	[1.85]	[1.93]	[2.01]	[1.93]	[1.87]
L3.Government Spending as Share of GDP (%)	-0.0771*	-0.0733*	-0.0818*	-0.0536	-0.0652	-0.0756*	-0.0622
	[-1.84]	[-1.75]	[-1.95]	[-1.28]	[-1.55]	[-1.82]	[-1.50]
L.logHStart	0.00993***	0.00961***	0.00955***	0.0107***	0.0106***	0.0107***	0.0102***
	[3.95]	[3.85]	[3.79]	[4.24]	[4.22]	[4.35]	[4.12]
L2.logHStart	-0.00411	-0.00391	-0.00411	-0.00776**	-0.00669*	-0.00483	-0.00390
	[-1.07]	[-1.03]	[-1.07]	[-2.07]	[-1.79]	[-1.28]	[-1.04]
L3.logHStart	-0.00193	-0.00343	-0.00305	-0.00198	-0.00285	-0.00294	-0.00170
	[-0.68]	[-1.24]	[-1.09]	[-0.76]	[-1.10]	[-1.06]	[-0.60]
L.Exports as Percentage of RGDP	0.215*	0.217*	0.207*			0.246**	0.218*
	[1.77]	[1.80]	[1.69]			[2.05]	[1.82]
L2.Exports as Percentage of RGDP	0.0151	-0.0124	-0.00420			0.0212	0.0180
	[0.09]	[-0.07]	[-0.02]			[0.13]	[0.11]
L3.Exports as Percentage of RGDP	-0.108	-0.172	-0.146			-0.188	-0.120
	[-0.89]	[-1.45]	[-1.22]			[-1.60]	[-1.01]
Observations	213	213	213	213	213	213	213

t statistics in brackets
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: VAR Estimations (continuation)

	(1) Baseline Model	(2) Break 1970	(3) Break 1980	(4) Estimation 4	(5) Estimation 5	(6) Estimation 6	(7) Full Model
REmpGap							
L.Imports as Percentage of RGDP	-0.210**	-0.237**	-0.228**		-0.113	-0.218**	-0.203*
	[-1.98]	[-2.25]	[-2.13]		[-1.23]	[-2.05]	[-1.93]
L2.Imports as Percentage of RGDP	-0.0713	-0.0514	-0.0550		-0.0478	-0.0640	-0.0787
	[-0.48]	[-0.35]	[-0.37]		[-0.38]	[-0.43]	[-0.54]
L3.Imports as Percentage of RGDP	0.245**	0.265***	0.268***		0.163*	0.253**	0.214**
	[2.38]	[2.60]	[2.58]		[1.78]	[2.47]	[2.08]
L.Employment in Services as Percentage of Total	-0.0285	0.00354	-0.0637				0.102
	[-0.11]	[0.01]	[-0.24]				[0.38]
L2.Employment in Services as Percentage of Total	0.516	0.551	0.570				0.450
	[1.20]	[1.29]	[1.32]				[1.06]
L3.Employment in Services as Percentage of Total	-0.486*	-0.554**	-0.517*				-0.516*
	[-1.78]	[-2.03]	[-1.88]				[-1.92]
L.DProd	-0.0000657	-0.000172	-0.000140	-0.000151	-0.000211	-0.0000842	-0.0000710
	[-0.17]	[-0.46]	[-0.37]	[-0.41]	[-0.56]	[-0.22]	[-0.19]
L2.DProd	0.0000435	-0.0000497	-0.0000145	0.0000547	-0.0000240	-0.0000615	0.0000296
	[0.12]	[-0.14]	[-0.04]	[0.15]	[-0.06]	[-0.17]	[0.08]
L3.DProd	0.000794**	0.000715**	0.000760**	0.000570	0.000742**	0.000744**	0.000733**
	[2.22]	[2.01]	[2.12]	[1.61]	[2.05]	[2.08]	[2.08]
Break90	-0.00178			-0.00116	-0.000925	-0.00197*	-0.00263**
	[-1.60]			[-1.64]	[-1.19]	[-1.87]	[-2.28]
Break70		-0.00226**		-0.00223**	-0.00194*	-0.00218**	-0.00336***
		[-2.03]		[-2.25]	[-1.82]	[-2.02]	[-2.68]
Break80			0.000248	-0.000348	-0.000122	-0.0000904	-0.00124
			[0.27]	[-0.53]	[-0.18]	[-0.14]	[-1.23]
Constant	-0.0405*	-0.0101	-0.0135	0.00395	0.00101	-0.0183	-0.0583**
	[-1.66]	[-0.51]	[-0.59]	[0.59]	[0.12]	[-1.11]	[-2.02]
Observations	213	213	213	213	213	213	213

t statistics in brackets
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As with any complex model, no single estimation is sufficient to understand the links between these variables. As such, a number of other estimates were produced to give a more complete picture of the relationship of these variables to jobless recoveries and the employment gap. The Break variable was redefined to occur at different times: in 1970 and 1980. In addition, a series

of other estimates were regressed, each time adding extra variables to the model to see if any major changes in the coefficients or their significance occurred.

Like the baseline model, many of the variables were consistently significant or insignificant across all seven estimations. Government spending was slightly significant while housing starts remains highly significant in each of the models, especially during the first lag. Again, as in the original model, exports were not significant while imports were highly significant, particularly in the first and third lags. The sectoral mix is only marginally significant in these models, particularly in the third lag period. Productivity is highly significant in the third lag as well. Each of the three *Break* variables – used as a catch-all for any exogenous shocks or structural changes that could not be explicitly defined in the model – yielded interesting results as well. While the break, at 1990, was only barely significant in the original model, it became highly significant in the "Full" model, which included every variable plus three dummy variables as breaks in 1970, 1980, and 1990. The 1970 Break value was also significant in both model in which it was the sole dummy variable and in the final, most inclusive model. Interestingly, the 1980 Break value was statistically insignificant across all models in which it was included, while the 1970 Break value was significant across all models and the1990 Break value was significant in three of five. It was most significant in the estimation that included every variable in the analysis. These results show that there is the potential for some sort of structural change or exogenous shock to have occurred after 1970 and after 1990.

Along with these seven estimations, another model was run using the changes in each variable over each quarter to the change in the employment gap over the entire time series. The results of this "Change-In" model are listed in Table 4. They are pretty consistent with the results from the

Table 4: "Change-In" Model VAR Estimates

	(1) Change-In Model
D_REmpGap	
LD.Government Spending as Share of GDP (%)	-0.0662
	[-1.44]
L2D.Government Spending as Share of GDP (%)	0.0309
	[0.68]
L3D.Government Spending as Share of GDP (%)	-0.0353
	[-0.80]
LD.New Privately Owned Housing Starts	0.00000626***
	[3.35]
L2D.New Privately Owned Housing Starts	0.00000575***
	[2.91]
L3D.New Privately Owned Housing Starts	0.00000108
	[0.54]
LD.Exports as Percentage of RGDP	0.157
	[1.22]
L2D.Exports as Percentage of RGDP	0.0803
	[0.63]
L3D.Exports as Percentage of RGDP	-0.118
	[-0.94]
LD.Imports as Percentage of RGDP	-0.0710
	[-0.64]
L2D.Imports as Percentage of RGDP	-0.126
	[-1.16]
L3D.Imports as Percentage of RGDP	0.0710
	[0.66]
LD.Employment in Services as Percentage of Total	-0.287
	[-1.02]
L2D.Employment in Services as Percentage of Total	0.470
	[1.60]
L3D.Employment in Services as Percentage of Total	-0.242
	[-0.83]
L.DProd	0.0000193
	[0.05]
L2.DProd	0.000286
	[0.72]
L3.DProd	0.000928**
	[2.43]
D.Break90	0.00317
	[1.16]
Constant	-0.000347
	[-0.69]
Observations	212

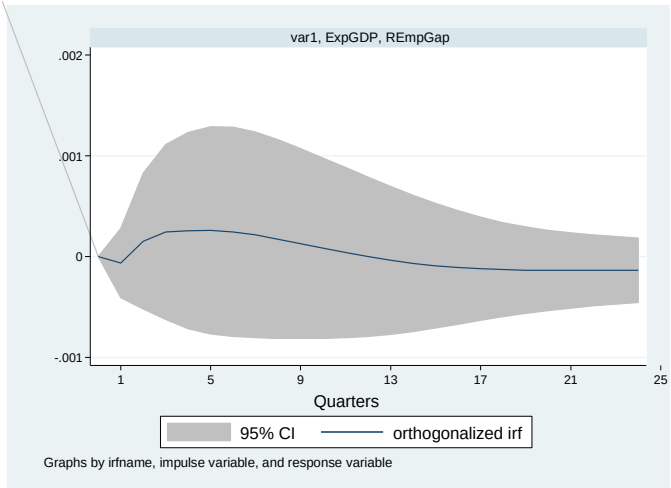
t statistics in brackets
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

other models, although imports and the sectoral mix do not appear to be as significant as in the prior estimations.

As a point of information, other VAR estimations were conducted in addition to the core tests shown in Table 3. Specifically, variables were added, dropped, replaced, or manipulated to create new models in an attempt to find the best fitting combination of factors. Even though the model estimates listed in Table 3 appear to be the most precise, other regressions were run to examine the various effects of different variables and factors. First, the alternative measures for government and housing, employment in government and employment in construction, replaced the primary measures of government spending and housing starts. The results were no better, and in some ways worse, as fewer variables were actually significant. In addition, we transformed the employment gap series into a logarithmic function, which yielded little statistical difference from the original, non-logarithmic specifications.

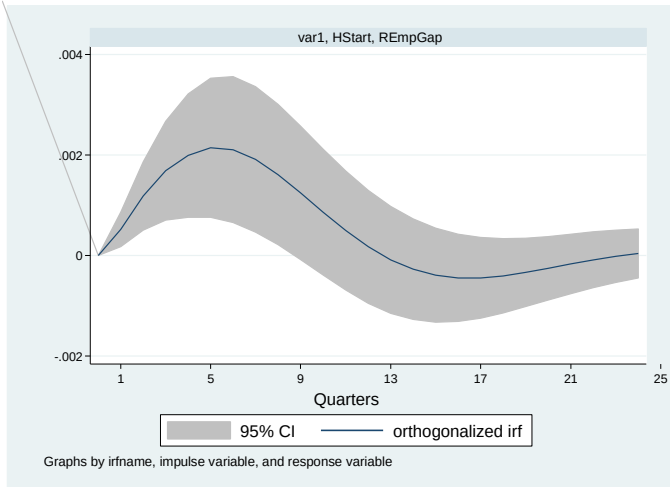
In addition to these VAR estimates, the IRF results are critical to understanding the effects of these variables on the employment gap and their ability to explain the jobless recovery. Because the distinct shocks to the dependent variable help to isolate the two variables in question, rather than testing the systemic relationship between all of the factors in the model as was done with the VAR, the IRF is able to reveal the causal relationship between the variable of interest and its selected determinants, along with its level of impact. Contrary to the VAR, the IRF of government spending on the adjusted employment gap was negligible, with a very small reaction to the shock, as seen in Figure 5. Because the confidence interval of 95% always encompasses zero, we cannot find evidence to support that a shock to government spending has a significant impact upon the employment gap. In addition, the lag is virtually nonexistent. The same test

Figure 5: IRF of Government Spending and the Employment Gap



conducted with housing starts yields differing results, showing that this factor does have a significant impact upon the employment gap. Illustrated in Figure 6, a shock to housing starts

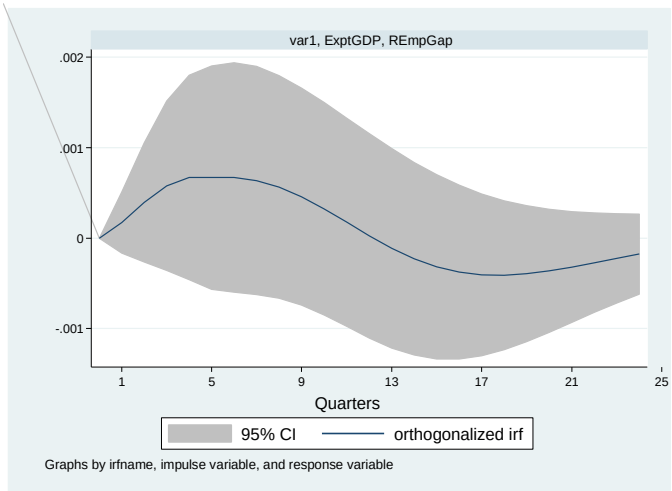
Figure 6: IRF from Housing Starts to the Employment Gap



had a large and significant influence on the employment gap, with a lagging impact of approximately eight quarters. We can see this effect in the white space between 0 and approximately .001 on the vertical axis, and 1 and 9 on the horizontal axis. This shows that we

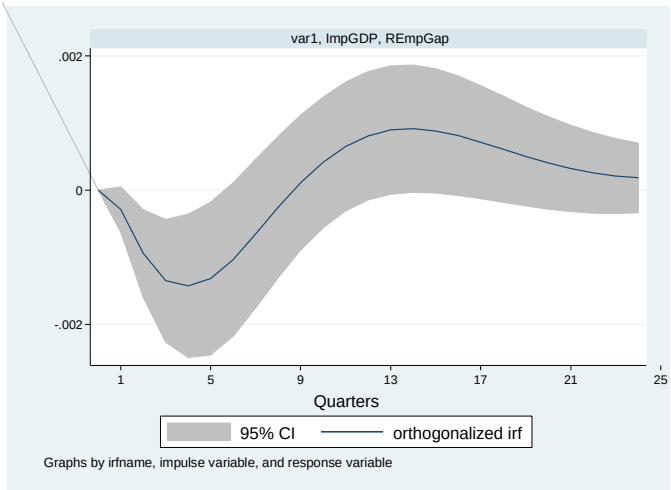
can have 95% confidence that a shock to housing is significant because that shock produces an impact that does not include the zero value in its interval. Figure 7, shows the IRF for a shock to

Figure 7: IRF of Exports and the Employment Gap



exports and its impact on the employment gap. In this case, there appears not to be a relationship between the two, consistent with the VAR estimates as well. On the contrary, a shock to imports

Figure 8: IRF of Imports and the Employment Gap

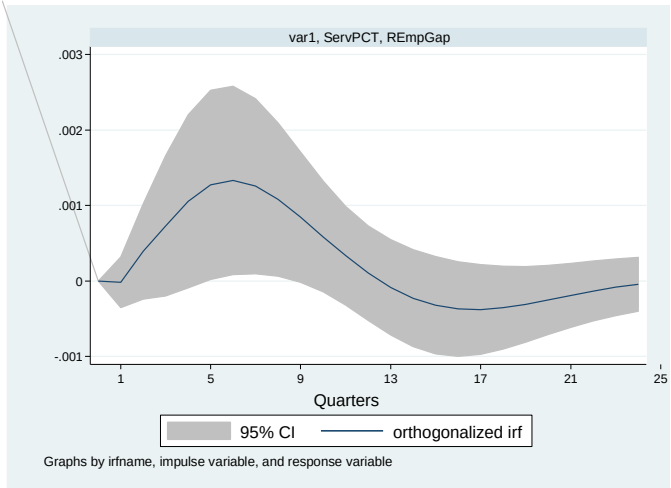


produces a meaningful impact on the employment gap, as illustrated in Figure 8. Here, the response to the shock is larger than the shock from the housing market at approximately .175%

of the employment gap, but is shorter, only persisting for about four quarters. In essence, the first effects of the shock are felt very quickly, but then erased relatively quickly from the economy.

The IRF of the sectoral mix, or ratio of services in the economy, yields a miniscule impact on the employment gap, as shown in Figure 9. Essentially, this means that there was a drastic change

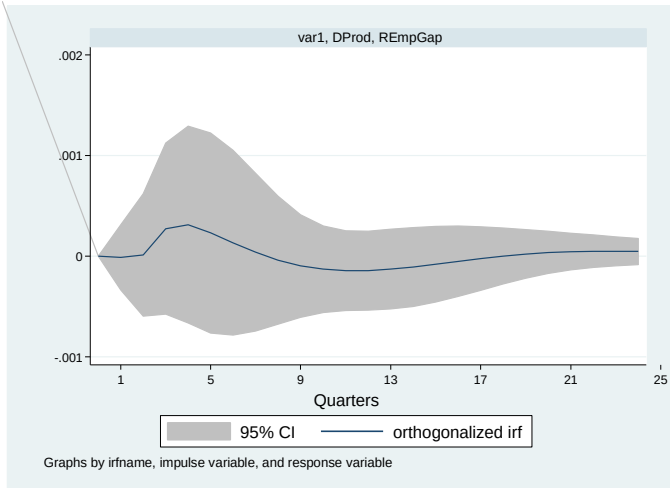
Figure 9: IRF of Percentage of Services and the Employment Gap



in the type of output firms produce in an economy. The confidence interval of the response briefly excludes zero, showing that the shock can be assumed to be at least marginally significant. Like with imports, the effect lasts for about four quarters, even though its absolute effect is almost negligible. Lastly, Figure 10 portrays the impact of a shock to productivity on the employment gap. In this instance, the shock is insignificant and very small to begin with. It appears as though productivity does not have much effect in this model, consistent with the VAR estimates.

The most important takeaway from the multiple VAR analyses is that no matter the alterations made to the specification or the variables in the model, the results did not change considerably.

Figure 10: IRF of Productivity and the Employment Gap



Furthermore, the significance of the *Break* variable shows the potential for a correlation between other exogenous factors and changes in the employment gap that were not included in the model. This, combined with the results of the HP Filter, shows that the structure and characteristics of the business cycle has changed over the last six decades, but further study is necessary to understand the full causes of this phenomenon.

5. Conclusion

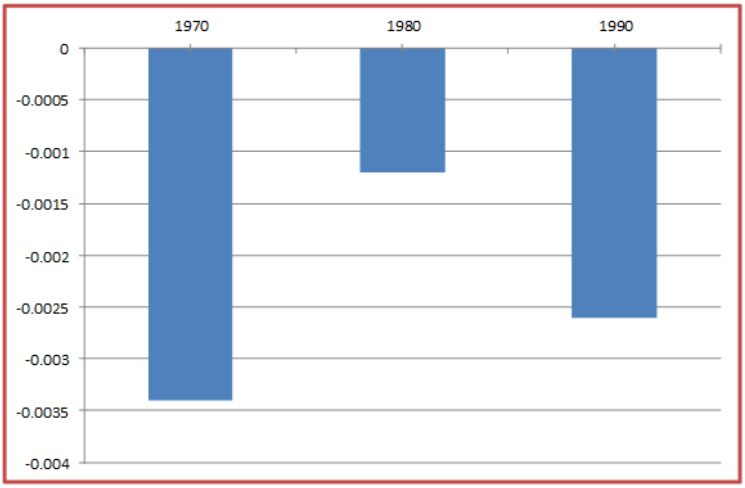
The empirical analysis provides evidence that performance in the housing and imports sectors along with the industrial mix of the economy - and to a lesser extent, government spending and productivity - have a significant impact on the size employment gap in the United States. In contrast, it appears as though exports have no influence on the size employment gap. In essence, we have isolated a few of the key factors that seem to have an outsize effect on the employment gap, and thus may help to explain these jobless recoveries in the U.S. economy because they have been consistently significant in the each model. Moreover, the "Break" variables are also significant. They provide strong evidence for some type of structural change and exogenous

shock during this time period, especially in the 1970s and 1990s. The change in the 1990s is consistent with the original hypothesis and does support the idea that some substantial shift in the U.S. economy did occur around this time.

It appears as though the theories of Keynes and Schumpeter are the best fits for explaining the employment gap and jobless recoveries in the United States as previously thought when simply examining the literature and their theories. The quantitative analysis supports Keynesian theory that changes to demand-side factors like housing investments, imports, and government spending. Schumpeter's theories also fit rather well especially when look at broad structural shifts like changes to productivity or the sectoral mix of the U.S. economy that has been altered significantly over the past sixty years.

Taking a broader perspective, this analysis shows that there have indeed been considerable changes to the employment gap in the United States over the last six decades. Going back to the employment gap illustrations in Figures 3 and 4, we can see that the business cycle has expanded over time. The size of the employment gap is not necessarily larger than ever before, but the length of the cyclical expansions and contractions that are inherent in capitalist economies are now much longer. Interestingly, the employment gap has both expanded and contracted during the time period examined in this study. The coefficients of the "Break" variables (Table 3) show that the employment gap was 0.34% larger in the 1970s than before 1970. Interestingly, the gap shrunk to just 0.12% in the 1980s compared with the years prior to 1970. The gap grew again in the 1990s, now 0.26% larger than it was in the forty-plus years before 1970. These estimates can be seen in Figure 11. These numbers may appear to be small, but in a labor pool of approximately 140 million, they are actually quite substantial.

Figure 11: Size Change in the Adjusted Employment Gap



Weighing all of the results, there is reasonable evidence to suggest that there have been jobless recoveries in the U.S. economy during the last three business cycles. Because time is the key factor in defining a jobless recovery– that it takes longer for employment to return to its pre-recession level than it does for output – and the analysis shows that the employment gap is taking more time to correct itself around the equilibrium point, there is solid evidence for the existence of jobless recoveries. This can be seen in Figure 3 in the results of the application of the H-P Filter and in the raw data, which shows significant increases in employment recovery times from 3-4 quarters during the period 1947-1989 to eight, thirteen, and thirteen quarters in the 1990, 2001, and 2009 recoveries, respectively. Because the size of the employment gap, and thus the business cycle, has become more protracted over this period, the time for the recovery of full employment is also extended. In essence, the effects of the recession are felt for a longer period as the economy recovers more slowly, thus the recovery does not actually seem to be a true recovery given its slow movement.

6. Implications

Protracted business cycles may lead to less volatility in the economy given that there are fewer boom-bust cycles over any period of time, but the expansions and contractions could consequently be more severe. In capitalist theory, expansions are not only periods of economic growth, but they are also periods in which inefficiencies accumulate in the production process. Therefore, contractions may be necessary in order to rid the economy of these inefficiencies. For instance, the market removes excess labor or capital in use and also replaces poor business practices. Looking at this dynamic in the context of this study, it is likely that jobless recoveries would continue to persist given the extension of the economic recovery process.

Additional insight into the future performance of the U.S. economy can be gleaned by looking at the significant variables analyzed within the context of these broader changes. First, housing and construction had a significant impact on the employment gap, thus if it continues to play a dominant role in the economy like it did leading up to the 2008 financial crisis, it could help cement the trend of jobless recoveries. Similarly, the predominance of service industries could also contribute to the continuation of this trend, as it was shown to be significant in many of the econometric models outlined in Section 4. Productivity was also somewhat significant, and its continued growth could also contribute to the continued changes in the employment gap. However, its slower growth in recent decades may actually help to narrow the gap and enhance the need for faster recoveries in the labor market. The importance of imports highlights the major role that consumption continues to play in the economy and its role in supporting the overall health of the economy. Finally, the significance of government spending emphasizes the role that government does play in the business cycle and the employment gap. Because it is

show to have some impact, government policy could both positively and negatively affect this trend. Policymakers should be mindful that their decisions do have real and tangible consequences on economic activity.

As stated earlier, the longer expansions and the protraction of the business cycle will likely lead to longer market recoveries and market corrections. This begs the question of whether this extended process is more economically efficient than the volatility that comes with shorter, faster business cycles. That is a difficult question to answer and one that this analysis does not attempt to answer, but there are a few key points to keep in mind. First, the idle capital and substantial deterioration of worker skills that come from extended periods of slow growth are harmful both in the short run and the long run. These are wasted economic resources not only during the more severe contraction but also during the longer recovery process. Second, are the extra inefficiencies accumulated during larger expansions worth the extended period of growth, and is there actually real economic growth taking place as opposed to run-ups in asset prices or inflation? In essence, is there an economic net benefit to longer business cycles and extended employment gaps?

This paper argues that it is likely that this trend will continue: the employment gap and the business cycle are likely to be more protracted and therefore we will continue to feel the effects of 'jobless recoveries.' If this is indeed the 'new normal' in the U.S. economy, then the many economic actors will have to accommodate it. In response to the questions posed at the end of the previous paragraph, if there is a larger economic benefit to this structural change, then the market should simply adjust accordingly and "absorb" the change into the economy's operation.

If this phenomenon is a net loss for the economy, then this would theoretically be a market failure that may actually justify outside intervention. Therefore, policymakers should be prepared to confront this challenge. For instance, they could increase funding for skills retraining programs or extend the duration of unemployment insurance as ways to counter the slow recovery of labor markets during this period. This could combat the loss of skills and the loss of income that are detrimental to economic productivity and economic growth. In addition, it is more likely that fiscal policy will be more effective at confronting this challenge than monetary policy, given that many of the factors that appear to affect the employment gap lie outside of the monetary system. Therefore, policies of such as extended low interest rates or increases in the money supply are likely to be relatively ineffective, and this is somewhat evident today as these policies have failed to swiftly and substantially close the employment gap in the most recent recovery. Ultimately, because jobless recoveries have a negative impact on the economy as whole, these new policies should help mitigate the harmful effects and attempt to counter the economic forces that are hurting workers and stunting broad-based growth in the economy at large. Ignored, this economic shift could have profoundly adverse implications for the long-run growth trajectory in the U.S. economy and overall standard of living for its citizens.

7. Areas for Further Study

While the results discussed in this paper can show that a number of new factors are significant, the model estimated in this study excludes other factors that could actually be significant, particularly those factors already discussed in the existing literature because they were either extensively studied or difficult to quantify. For example, it was difficult to quantify changes in business practices or labor market flexibility, two determinants that were mentioned fairly often

in the literature. In addition, the role of healthcare costs was briefly mentioned in the literature, but not addressed in this study. Given its growing importance in the U.S. economy and its impact on U.S. employers, it is worth a closer look. Also, it may be important to look at monetary factors like real interest rates, money supply growth, or the price level as potential variables that could further explain the changes to the employment gap. These factors were not covered in this analysis, but their role could be significant.

Further studies should look to determine what kind of structural change occurred, particularly around the years of 1970 and 1990, based on the results of the VAR estimations. It is likely that there was some kind of change, but the nature of that change remains unknown. Finally, because this study analyzed the size of the employment gap, future studies should look to examine the duration of the employment gap. This study highlighted some of the key explanatory factors of the employment gap itself, but it also remains unknown why the employment gap persists for as long as it does. This could be a useful insight into understanding future business cycles and their cyclical performance and also have considerable policy implications.

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