An In-depth Analysis on the U.S. Economic Cyclical Impact on the World Economy

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Abstract. After the financial crisis of 2008, the Federal Reserve conducted a new round of target rate increases for US federal funds. The accelerated process of economic globalization has led to the spread of small-scale financial turmoil in neighboring countries, leading to larger crises, and to increasingly pronounced synchronized fluctuations in economic cycles among countries. Therefore, an in-depth study of the economic synergies between the U.S. and the rest of the world and a quantitative analysis of the world's economic transmission factors are of great practical significance in promoting the healthy development of the economy, reducing the negative impacts and influences brought about by the fluctuations of other countries' economies, and, in particular, in coping with the spreading of the economic crisis. The central idea of this paper will focus on the economic synergy between the United States and other countries in the world, first of all, it will introduce the background of the topic and the significance of the research, and then summarize the current research on the analysis of scholars on the impact of policy adjustments from the channel of capital flows, the impact on the developed economies, and the combination of empirical research in order to make it clear that in the big country game environment, U.S. monetary policy adjustments brought about by the impact of the multiple perspectives of multi-level research methodology. On this basis, we summarize the adjustments facing the world economy as the United States enters the interest rate hike cycle.

Keywords: Economic Cyclicality, Quantitative Analysis, Granger Causality Test.

1. Introduction

After three years of epidemics, the world economic cycle has entered a "recession" and is moving towards a "recovery". The movement of the world economic cycle is influenced by many factors, among which the implementation of monetary policy by countries around the world becomes particularly important. On this basis, the United States as one of the world's largest economies, its monetary policy changes on the world economic cycle and other national economies have an important impact. The monetary policy of the United States is formulated and implemented by the Federal Reserve (the U.S. Federal Reserve Board). The conduct of monetary policy in the United States directly affects the exchange rate of the United States dollar and the stability of the international monetary system. [1] Global trade and commodity pricing are usually denominated in U.S. dollars, which makes the U.S. monetary policy has a wide range of influence in the global context. At the same time, U.S. monetary policy adjustments have direct and indirect impacts on global financial markets. The Fed's decisions trigger global capital flows, which affect the performance of global stock, bond and commodity markets.

The Fed controls the money supply and monetary liquidity by adjusting short-term interest rates, such as the federal funds rate. When the Fed raises interest rates, the attractiveness of U.S. assets increases and international investors tend to flow funds to the U.S., leading to the risk of capital outflows from other countries. Conversely, Fed rate cuts may lead to international capital flows to other high-yield markets, affecting global capital flows. At the same time, monetary policy adjustments can also affect the dollar's exchange rate. An interest rate hike usually leads to an appreciation of the U.S. dollar, while an interest rate cut may lead to a depreciation of the U.S.dollar. Changes in the dollar's exchange rate have an important impact on global trade and investment, as most global trade and commodity pricing is denominated in dollars. [2]The impact of U.S. monetary policy is not unidirectional. Global economic conditions, the policies of other

major economies, and the interplay of global trade and financial markets also affect U.S. monetary policy choices in turn. Thus, the global economic cycle is a complex interconnected system in which multiple factors intertwine to shape the trends of the world economy.

Nowadays, there are some malefactors on the impact of the US monetary policy on the economic development of other countries, but most of these malefactors are based on the impact of the US quantitative easing monetary policy on the fluctuation of the global economy, and there are relatively few research documents based on the direction of the US implementation of the conventional monetary policy. [3]However, changes in the monetary policy of a superpower such as the United States are likely to affect the economic development of countries around the world in one way or another. Therefore, we intend to use theoretical and quantitative analyses to study the correlation between the monetary policy of the US and the international flow of capital as well as the world economic cycle, and to analyze in depth the pros and cons of the current tightening monetary policy, which is therefore of some theoretical significance.

2. The US Economy is cyclical

It is a common phenomenon in economics that the United States economy is cyclical, often referred to as the economic cycle, shown in the Table1. This cyclicality is characterized by fluctuations in economic activity over a certain time frame, covering employment, output, and price levels. Economic cycles can usually be categorized into four phases: expansion, peak, recession, and bottom. During the expansion phase, the U.S. economy is characterized by growth and prosperity. During this period, the gross domestic product (GDP) grows, corporate profits increase, unemployment decreases, consumer confidence is high, and investment activity increases, all of which are possible reasons that would influence the economy to show growth. Positive government policies and the external environment tended to promote positive economic growth. [4]However, excessive optimism and over-investment can sometimes lead to the formation of economic bubbles. The peak phase is the culmination of the expansionary phase and is usually accompanied by a high level of economic activity. During this phase, GDP reaches its temporary peak and employment may be close to full employment levels. However, excessive prosperity may also lead to overutilization of resources and increased inflation, which may trigger the ensuing adjustment. The recessionary phase is a phase of declining economic activity, also known as a recession or economic crisis. During this phase, GDP begins to fall, corporate profits decrease, unemployment rises, and consumer confidence declines. This can be due to a combination of internal and external factors such as financial crisis, high inflation, and negative market sentiment. Governments and central banks usually adopt policies to stimulate the economy in order to slow down the effects of recession. The bottom stage is the trough of a recession and is also known as the bottom of the economy.

During this stage, economic activity reaches its lowest point, but it also usually marks the beginning of a recovery. [5] Government stimulus in the form of fiscal and monetary policies may gradually have an impact, corporate profits and consumer confidence may begin to recover, and unemployment may fall slightly. But an economic cycle is not a fixed period of time, and its duration and magnitude can vary according to a number of factors. These factors include internal and external economic events, government policies, technological innovation, and international trade. In addition, economic cycles are not entirely predictable, and economists typically analyze historical data, market trends, and other factors to predict the likely direction of the economy

Table 1. U.S. Economic Annual Change (sourse from: world bank)

2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
-0.44%	0.45%	0.42%	-1.04%	0.57%	0.70%	-0.65%	-5.06%	8.71%	-3.88%

3. The World Economy is cyclical

It is a widely recognized economic phenomenon that the world economy is cyclical, in the sense that economic activity undergoes alternating cycles of growth and recession over a given period of time. This cyclical phenomenon has existed for centuries and is not only visible within countries, but is also prevalent on a global scale.

3.1. Fundamental causes of cyclicality in the world economy

One of the fundamental causes of cyclicality in the world economy is fluctuations in supply and demand, shown in Table2. During a boom period, demand rises and firms increase production, creating more jobs and thus raising the level of economic activity. [6] However, in such situations, prices and inflation may rise, leading central banks to adopt tightening policies that dampen demand and the economy begins to slow down. This cyclicality is also linked to the investment and business cycle, where investment fluctuates over the cycle and firms adjust their capital expenditures according to market conditions. The real estate market is a clear example of fluctuating supply and demand. During a boom period, people's confidence is high and they tend to buy houses, demand rises and house prices increase. This leads to a booming real estate market. During a recession, confidence declines and people may postpone their home-buying decisions, leading to a real estate market where supply exceeds demand and home prices fall. This fluctuation in supply and demand can trigger fluctuations in the economic cycle in the real estate market. [7] Also the oil market is affected by fluctuations in supply and demand. When global demand increases, oil prices rise and supplying countries may increase production to meet demand. However, in times of economic slowdown or crisis, when demand falls and oil prices drop, supplying countries may reduce production to keep prices stable. Such fluctuations in supply and demand can lead to price volatility in the oil market, with implications for the global economy. Supply and demand also generate fluctuations in the labor market. During economic booms, firms usually need more labor to meet demand, unemployment falls, and wages rise. [8] However, during a recession, firms may lay off workers to reduce costs, resulting in higher unemployment and slower payroll growth. Such fluctuations in supply and demand in the labor market can affect individual employment opportunities and payrolls. There are also consumer goods markets that are affected by fluctuations in supply and demand. During economic booms, consumer confidence is high and they are willing to spend more, demand rises and firms increase production. [9] Consumers may cut back on spending, demand falls and firms reduce production. Such fluctuations in supply and demand can lead to fluctuations in sales in the consumer goods market. These examples illustrate how fluctuations in supply and demand can trigger fluctuations in economic cycles in different markets. Changes in supply and demand have a direct impact on prices, production, employment and consumption, which in turn affects the performance of the economy as a whole. Therefore, fluctuations in supply and demand are considered to be one of the key factors in economic cyclicality. Another important cause is external shocks, such as natural disasters, political instability, international trade tensions, and other factors, which are events that can lead to fluctuations in economic activity. Natural disasters such as earthquakes, hurricanes, floods and droughts, for example, can have severe external shocks on the economy. [9]A large-scale earthquake can destroy infrastructure, reduce farm yields and paralyze productive activities, leading to a short-term economic downturn. Such external shocks usually require a period of reconstruction and recovery to repair the damage. Tensions in international trade relations can also generate external shocks to the world economy. For example, tariff wars or trade sanctions may lead to a reduction in international trade, affecting both exports and imports and adversely affecting domestic production and employment. [10] Political instability and conflict are also a form of external shock. When countries are caught in political crises, wars or social unrest, economic activity is usually affected. Reduced investment, capital outflows, disruptions in production and the evacuation of people can all have a negative impact on national and regional economies. Further global financial crises, such as the subprime mortgage crisis of 2008, are also external shocks to the world economy. [11] Such crises can propagate through the collapse of financial markets, credit crunch and corporate bankruptcies, triggering a global

recession. Also a global health crisis like the COVID- 19 pandemic can be considered as an external shock. Such crises have had a huge impact on industries such as tourism, restaurants and airlines, leading to a sharp decline in global economic activity. [12] These examples emphasize how external shocks can affect the world economy in different contexts. These shocks are often difficult to predict, but they can rapidly change supply and demand, market confidence and investment decisions, leading to fluctuations in the economic cycle. Governments and international organizations usually take measures to cope with external shocks in order to mitigate their adverse effects on the economy, such as fiscal stimulus, monetary policy adjustments and international cooperation to resolve trade disputes.

Table 2. World Economic Annual Change (sources include: World Bank)

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2.7%	2.8%	3.1%	3.1%	2.8%	3.4%	3.3%	-2.6%	-3.1%	5.9%

3.2. Economic cycles affect

Economic cycles affect the livelihoods of individuals and households. During periods of prosperity, it is usually easier for people to find work, salaries rise and the quality of life improves. However, during recessions and depressions, unemployment rises, households may fall into financial distress, and purchasing power declines. For example, during a boom, jobs usually increase and unemployment falls. This can be very beneficial to individuals and families as it is easier for them to find work, increase their income and improve their quality of life. For example, a family member may be able to find a better-paying job during a boom, improving the family's financial situation. [11]Also the economic cycle affects pay levels. During boom times, salaries typically rise due to high demand for labor. This means that an individual's salary may increase, giving them more disposable income. This can be used to improve living standards, save or invest. Economic cycles have an impact on household debt burdens. During a boom, it may be easier for individuals to obtain loans, but during a recession, at risk of losing their jobs and seeing their salaries fall, it may become more difficult to pay off debt. This can lead to increased financial stress and even default. Households' investment returns are also affected by the economic cycle. During booms, the stock market usually performs well and investment returns are high. However, during recessions, markets can be unstable and investment returns may suffer. This can affect a family's financial planning and retirement savings.[14] Economic cycles can also affect the purchasing power and spending habits of individuals and families[15]. During booms, people tend to spend more and buy more goods and services. However, during recessions and depressions, purchasing power may decline and people may cut back on spending and economize. Economic cycles have a significant impact on the real estate market. During booms, home prices usually rise, making real estate investments more attractive. However, during a recession, home prices may fall and it may become more difficult to purchase a home, which can affect a household's housing choices and investment decisions. Economic cycles can also affect an individual's educational and career choices. During booms, people may be more inclined to pursue higher educational attainment and career advancement because there are more job opportunities. However, during recessions, career choice may be limited and some industries may be hit harder. In short, the cyclical nature of the world economy has a wide-ranging impact on the lives of individuals and families. It can affect employment opportunities, salaries, debt loads, investments, purchasing power, real estate and career choices, etc. As a result, individuals and families often need to be flexible in responding to fluctuations in the economic cycle and make appropriate financial planning and decisions to maintain financial stability and quality of life.

Businesses experience fluctuations in supply and demand during economic cycles. Economic cycles have a direct impact on business sales and profits. During economic booms, when consumer confidence is high and demand rises, businesses are usually able to increase sales and realize higher profits. However, during a recession, demand falls, sales may decrease, and business profits may come under pressure. For example, an automaker may see a rise in car sales during a boom, but may face a decline in sales during a recession. Economic cycles can also affect business investment decisions. During boom periods, firms are usually more willing to make expansionary investments to

build new facilities, expand production capacity, or enter new markets. However, during economic downturns, firms may cut back on capital expenditures and postpone investment decisions in response to uncertainty and market downturns. Economic cycles affect a firm's hiring strategy. During booms, firms typically need more labor to meet demand and may therefore increase hiring. Conversely, during a recession, firms may need to cut costs and lay off workers in response to adverse market changes.[6] For example, the retail industry may increase hiring to meet demand during the holiday shopping season during a boom, but may cut staff during a recession. Economic cycles affect business financing conditions. During booms, credit markets are typically more accommodating and firms can more easily access capital and financing. However, during a recession, credit conditions may tighten and firms may have difficulty obtaining financing, which may affect expansion and growth plans. Economic cycles also affect the stability of a firm's supply chain. [9] During boom periods, supply chains may be more stable, but during economic downturns, partners in the supply chain may face difficulties and there is an increased risk of supply chain disruptions. This can lead to production delays and higher costs. Economic cycles also affect market pricing and the competitive landscape. During booms, firms may be able to increase the price of their products because demand is high. [5] During recessions, however, price competition may increase and firms may be forced to lower prices to attract more consumers.

Governments must implement various policies and measures to manage the economy and address issues during various economic cycles as a result of the international economy's cyclical nature. Governments often try to tighten fiscal policy during economic booms to prevent inflation. These options can be budget cuts, tax increases, or deficit reduction. In contrast, the government may implement fiscal stimulus measures during a recession to boost public spending, create job opportunities, and promote economic growth. For instance, to increase employment and economic activity, the government may invest in infrastructure development. In various economic cycles, central banks also implement varied monetary strategies. The central bank may increase interest rates during a boom to combat inflation and an overheating economy. In contrast, the central bank typically reduces interest rates during a recession to encourage investment and borrowing as well as to boost consumption and economic recovery. [6] The unemployment rate varies depending on the stage of the economic cycle. During recessions, governments are typically compelled to take action to reduce unemployment, such as by offering unemployment compensation, training opportunities, and re-employment programs. To aid those impacted by economic downturns, the government may also strengthen the social security system. The financial market may become unstable as a result of changes in the economic cycle. To ensure the stability of the financial system and avoid financial crises, governments may need to enhance financial regulation. For instance, tightening up risk management and surveillance measures, and improving banking supervision. International trade relations may also be affected by changes in economic cycles. To address trade imbalances and changes in the global trade environment, governments may adopt a variety of international trade policies. Governments may enact protectionist trade policies during recessions to save home businesses and jobs, whereas during boom times they could be more receptive to free trade and international collaboration. The management of the government's budget and debt is also impacted by the various economic cycle stages. Governments may be able to accumulate fiscal surpluses and lower their debt loads during boom times. To provide fiscal stimulus in response to a crisis, governments may need to expand debt during a recession. [7] Governments are affected by the cyclicality of the global economy in a number of policy areas, including budget management, regulation, unemployment insurance, and fiscal and monetary policy. To ensure economic stability and sustained development, governments must respond adaptably to the difficulties presented by various economic contexts. The success of these programs and initiatives will directly affect the economic and social health of the nation.

4. The impact of US monetary policy on US economic cyclicality

The covariance of the global economic cycle is a characteristic that is used to assess the degree of interdependence and consistency in the direction of the economic cycle fluctuations among the sample countries. When the inter-country economic cycle correlation coefficient is positive and becomes close to 1, it means that the inter-country economic cycle fluctuations are tightly associated and have a consistent tendency.[6] S stands for the probability value of the correlation coefficient's significance test. The correlation coefficient is more important the lower the value. In general, the correlation coefficient is very significant if the value of S is smaller than 0.5. A value of S less than 0.05 typically denotes a highly significant correlation coefficient. Twelve nations' economic swings exhibit a significant link with those of the global economy. Particularly, the correlation coefficients between the US economy and those of other countries tend to be higher, and they have a significant impact on the global economic cycle.

4.1. HP Filtering

Modern economic cycle empirical researchers place a strong emphasis on filtering time data to remove trends before focusing on the statistical traits of the malefactor. Linear trend filtering is the most basic type of filtering, however it requires that the sequence be a process that is trend-stable. According to the extant literature, differential filtering is the most straightforward filtering technique, however differential filtering has a tendency to enhance the time series' short-term noise factor. In conclusion, HP filter and BP filter, of which BK filter is an early version, are the two most often used filtering techniques.

In this paper, the GDP growth rates of each country are first processed using HP filtering, and then the relevance test is carried out. Empirical studies demonstrate that data series processed by HP filtering technique are suitable for economic cycle analysis with length ranging from 7 to 10 years, and HP filtering technique has better applicability to all kinds of data processing.

Finding the convergence of a series of samples T so as to reduce Z in the following equation is the fundamental idea behind HP filtering：

$$L = \sum_{t=1}^{T} (y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1} [(s_{t+1} - s_t) - (s_t - s_{t-1})]^2 \quad (1)$$

The balance between both varies on the parameters, but the objective function of HP filtering really penalizes both the data's departure from the trend and the trend's volatility. This is typically considered as 160 for quarterly data, 100 for annual data, and 14400 for monthly data.

4.2. Causal Tests of Cyclical Fluctuations in the U.S. and World Economies

We applied the Granger causality test to further understand the association between the periodic fluctuations in the US economy and the global economy as well as to establish the causal link between these fluctuations.

Table 3. Results of Granger causality tests of the growth rates of the U.S. Economy and the World Economy (k=2)

Suppose that...	observed value	F Statistics	P
USA-GDPZQ is not the Granger Cause of W-GDPZQ	35	2.89112	0.043
W-GDPZQ is not the Granger Cause of USA-GDPZQ	35	2.63472	0.051

At the significance level of a = 10%, the null hypothesis that USA_GDPZ Q (the cyclical volatility of the US real GDP growth rate) is the Granger cause of W_GDPZ Q (the cyclical volatility of the global real GDP growth rate) is rejected, indicating that U.S. GDPZ Q is the Granger cause of W GDPZQ. W GDPZQ is also the Granger cause of USA GDPZ Q at the same time. W GDPZ Q is also the Granger cause of USA GDPZQ at the same time. As a result, the test's findings indicate that W

GDPZQ is USA GDPZQ's Granger cause. The test's findings thus demonstrate that there is a causal connection between the US and global economies' swings.

5. Conclusion

First, we analyze the effects and constructions of the U.S. and global economic cycles. Then, we use a filter analysis to look at the degree of synchronization of the global cycle, showing that the U.S. economic cycle has the strongest correlation with the global cycle. Major central banks, international financial organizations, and academics have thought about the monetary policy framework since the response to the global financial crisis, given attention to financial stability, incorporated financial cycles into the monetary policy objectives, and investigated globally coordinated macroeconomic policies to address the instability brought on by the transmission of cyclical fluctuations. Countries have been able to eliminate geographic prejudice and improve global coordination and cooperation through transmitting cyclical changes.

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