Analysis of GDP of the United States (1981-2021)

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ABSTRACT. From relevant articles, the United States restored its economy from recessions since 1981, revealed by its real GDP. In the whole process, the questions appear as how United States made it-What caused the changes and what are the evidence for the policies of restoration. To figure out the reason behind, the GDP data is chosen as the main objective to study, where the elements of real GDP are individually analysed. Hence, the general mode of this work is to ana-lyse the extracted cyclicals of each element from the data, which are divided by removing GDP's trend, called Detrending. To implement it, standard deviation and correlation equations are used in the cyclical data of the annual GDP of the United States from 1981 to 2021. To further push forward the study, cyclical of each element is compared, which finally indicates that the long-term solution on economic restoration is to stimulate Consumption, which constantly and sustain-ably increases the GDP, and that short-term solution on economic restoration is to stimulate Investment, which pulls GDP up within a short period.

Keywords: Detrending, Cyclical, Recession, Recovery

1   Introduction

The primary purpose of this article is to figure out how Consumption, investment, and net export variation affect Gross Domestic Product through detrending the data of the United States from 1981 to 2021 and to get the conclusion to the recovery of the econ-omy in a short period or long period.

GDP, known as Gross Domestic Product, is a monetary measure of the market value of all the final goods and services produced and sold (not resold) in a specific period by countries [1]. Gross Domestic Product consists of Consumption, investment, gov-ernment spending, and net export [GDP=C+I+G+NX (Each letter is the capital of each component).

The significant reference value of the United States, which has been the biggest economy in the world since the 20th century, makes the United States a reliable object to study, drawing a relatively accurate and generally accepted economic conclusion.

From 1981 to 2021, the great recession starting in 2008 and the COVID recession starting in 2020 have greatly affected the global economy, which can be used to study cyclical factors of GDP.

The Great Recession had a significant economic and political impact on the United States. While the recession technically lasted from December 2007 – June 2009 (the nominal GDP trough), many important economic variables did not regain pre-recession (November or Q4 2007) levels until 2011–2016. For example, real GDP fell $650 billion (4.3%) and did not recover its $15 trillion pre-recession level until Q3 2011. Household net worth, which reflects the value of both stock markets and housing prices, fell $11.5 trillion (17.3%) and did not regain its pre-recession level of $66.4 trillion until Q3 2012. The number of persons with jobs (total non-farm payrolls) fell by 8.6 million (6.2%) and did not regain the pre-recession level of 138.3 million until May 2014. The unemployment rate peaked at 10.0% in October 2009 and did not return to its pre-recession level of 4.7% until May 2016.

The economic impact of the protests in the U.S. has exacerbated the COVID-19 recession by sharply curtailing consumer confidence. It costs an estimated $50 million. However, because of the lockdown implemented to slow down the spread of the virus before the first protests, unemployment suddenly rose suddenly in less than one month, leaving over 21 million without a job in the U.S. only (from 3+% to 14+%). Several small businesses, already suffering from the economic impact of the COVID-19 pandemic, were harmed by vandalism, property destruction, and looting. Curfews instated by local governments – in response to both the pandemic and protests – also have "restricted access to the downtown [areas]" to essential workers, lowering economic output [1].

BEA stands for Bureau of Economic Analysis of the U.S. Department of Commerce, where I download the raw data of the annual real GDP of the U.S. from 1981 to 2021. In the raw data, financial variables are trending, A feature that masks possible cycles. Detrending in the business cycle is to decompose actual variables, such as output, into a secular (or trend) component and a stationary, possibly cyclical, component. Concerning financial variables, the same approach has been taken [2]. Hence, to study the cyclical factor in the data, the trend of the data should be removed, using detrending as the methodology to process the raw data. To further decompose the data, I put GDP Cyclical, Consumption Cyclical, Investment Cyclical, Exports Cyclical, and Imports Cyclical into comparison through standard deviation and correlation equation to figure out the connection of GDP with Consumption, investment, exports and imports.

2   Literature Review

In the article Consumption and the recession of 1990-1991. Olivier Blanchard. (1993b). What has been proved in the article is that Consumption is an effective index that foresees the coming recession. Moreover, the article also claims that there are two main features of recession's impact on consumption "The first is that income shocks have only transitory effects on Consumption and income; their effect is largely gone within two years. The second is that shocks to Consumption have long-lasting, hump-shaped effects on output and, to a lesser extent, on consumption" [3]. Moreover, this is helpful to the study of how great Consumption can affect GDP in another way. In the article Interest Rate Risk and Other Determinants of Post-WWII US Government Debt/GDP

Dynamics [10], it's helpful to know the effect of the government budget on the GDP. Also, in the article The Uncertain Trend in U.S. GDP [7], the trend is uncertain when it comes to the shocks of post-war. Are there any reliable leading indicators for US Inflation and GDP Growth? [8] and Co-integration with score-driven models: an application to US real GDP growth, US inflation rate, and effective federal funds rate [9], the selection of the economic model is well considered directed by the analysis of these articles. Furthermore, in Detrending and Financial Cycle Facts Across G7 Countries: Mind a Spurious Medium Term! Schüler, Y. S. (2018). I obtain the methodology to process further the data, which is detrending. Furthermore, this article gives an example of detrending G7 countries to introduce further and decompose methodology. The results indicate that the detrending of financial variables across G7 countries with H.P. and bandpass filters leads to spurious cycles, resulting, for instance, in similar durations of cyclical phases across countries and variables [2]. The results of this article, as the author, said that" mind a spurious medium!" reminds me to be cautious about the results using H.P. and bandpass filters, which lead to furious spurious cycles. The failure of the Keynesian Theory in the 1970s has caused many economists to want to return to the study of business cycles as equilibrium phenomena [4]. As for what Keynesian Theory is, Keynesian economics (sometimes Keynesianism, named after British economist John Maynard Keynes) are the various macroeconomic theories and models of how aggregate demand (total spending in the economy) strongly influences economic output and inflation. In the Keynesian view, aggregate demand does not necessarily equal the productive capacity of the economy. Instead, it is influenced by a host of factors – sometimes behaving erratically – affecting production, employment, and inflation [1]. Meanwhile, Postwar Financial Crises and Economic Recoveries in the United States. David Lopez-Salido, & Edward Nelson. (2010). Shows that even though the economic departments are in a weak period, it is still practical to use strong, demanding policies to stimulate the economy's growth. It suggests that the critical factor is aggregate demand policy. If the output is demand-determined in the short run, strongly stimulative aggregate demand policies can have their effects felt on output even when the financial sector is weak. And, as suggested in the introduction, a rapid economic expansion could then relieve the positions of banks considerably, further diminishing the effects of the prior financial crisis. These considerations suggest that judgments about the effects of financial crises on output behavior in the United States require an even greater focus on the factors bearing on aggregate demand [5]. As it is revealed, Consumption and investment are of aggregate demand, which is necessary for governmental policies. In fact, the significant drivers of debt increases are the inevitable collapse in tax revenues that governments suffer in the wake of deep and prolonged output contractions, as well as often ambitious countercyclical fiscal policies in advanced economies aimed at mitigating the downturn [6]. This tells that government usually suffers from recession and needs to adjust its policies, relying on the Consumption and investment situation.

3   Methodology

In this article, Detrending is used as the suitable methodology to process the data. First, list the data, and insert a 2D chart of the data. Then show the trendline and the equation of the trend of the data. After having the trendline equation, the original values minus the trend values get the difference. Using this equation: **Cyclical=Difference/Trend** to get cyclical of the data. And this is the whole process of the methodology used in this article.

4   Data

In Gross Domestic Product of U.S. from 1981 to 2021, it introduces the raw data of the Gross Domestic Products of the United States from 1981 to 2021 with the trendline of the data labelled blue in it, which is an assist for further detrending. Obviously, it is told from this chart that it is increasing as the timeline progresses. What is needed is to remove the trend of the data, called detrending.
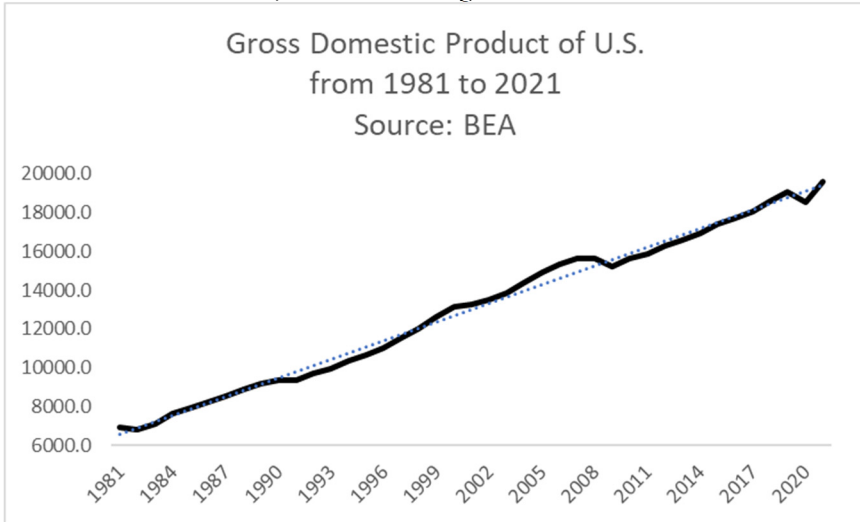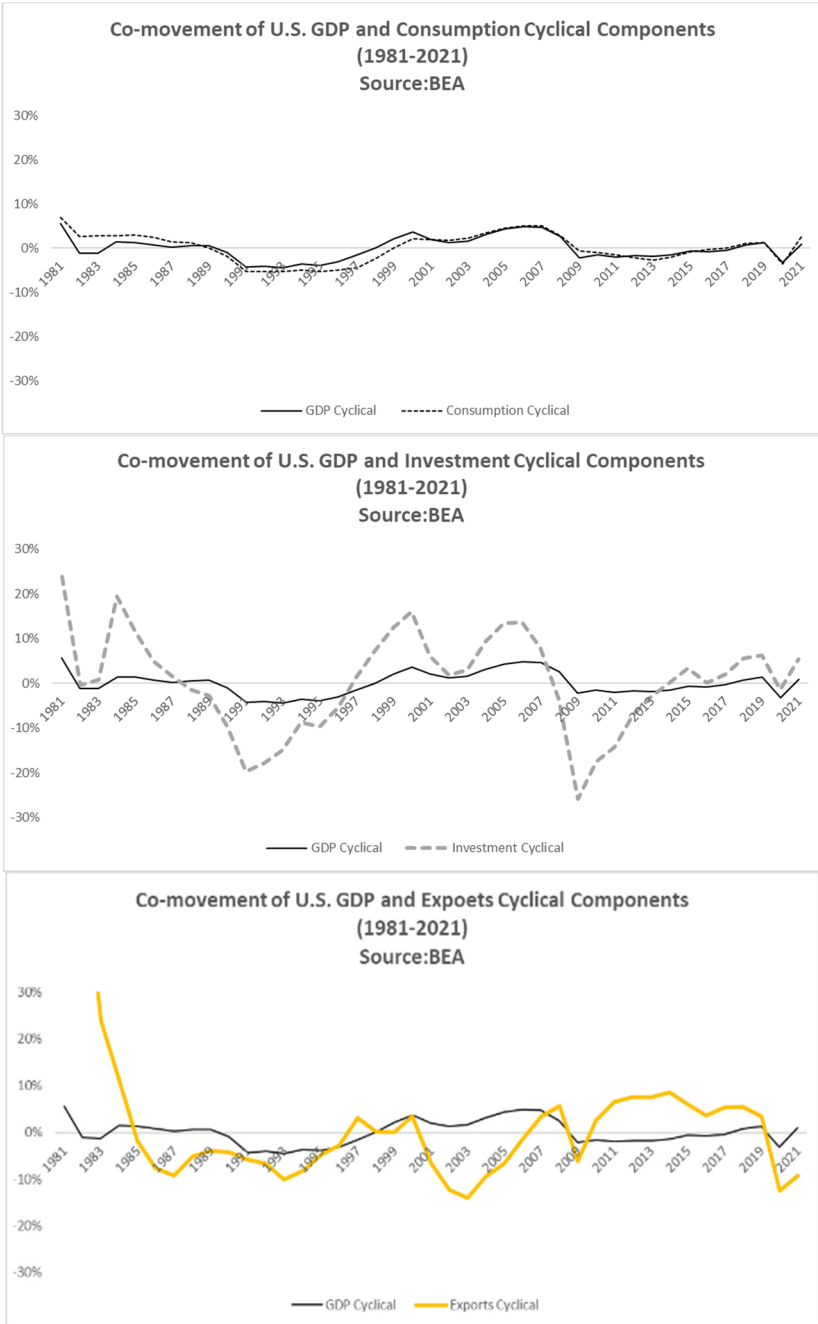

Fig. 1. Gross Domestic Product of U.S. from 1981 to 2021

After a series of processing, each cyclical is shown in Figure 2. And for further use, I made comparison charts which have GDP compared with Consumption, Investment, Exports and Imports.
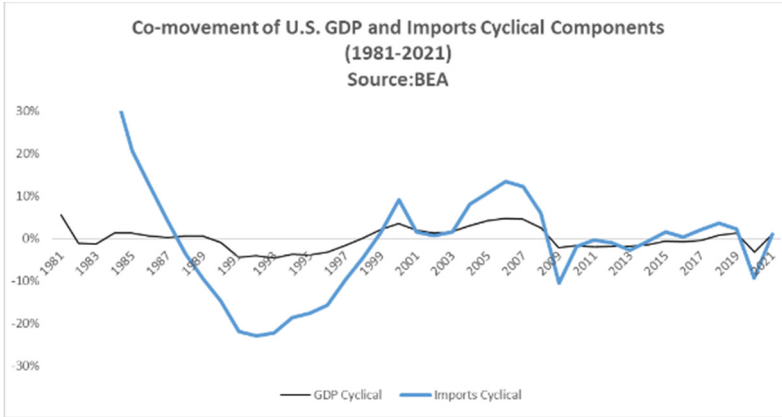
Co-movement of U.S. GDP and Consumption Cyclical Components (1981-2021) Source:BEA

Co-movement of U.S. GDP and Investment Cyclical Components (1981-2021) Source:BEA

Co-movement of U.S. GDP and Expoets Cyclical Components (1981-2021) Source:BEA

Fig. 2. Co-movement of U.S. GDP and each element Cyclical Components

Then combining the Figure 1 with Figure 2, it is concluded that GDP and Consumption, GDP and Investment are highly correlated. And through dividing each standard deviation value into GDP's, I find that their frequency of fluctuation is 1, 4, 9, 11 times higher than the GDP's. Table 1 shows the cyclical Standard Deviation.

Table 1. Cyclical Standard Deviation

GDP Cyc SD	0.0263			
Consumption Cyc SD	0.0329			
Investment Cyc SD	0.1090			
Exports Cyc SD	0.2415			
Imports Cyc SD	0.2749			
GDP & Consumption Correlation	0.9063			
GDP & Investment Correlation	0.8123			
GDP & Exports Correlation	0.2845			
GDP & Imports Correlation	0.5516			
The ratio of GDP to	Consumption	Investment	Exports	Imports
	1.3	4.1	9.2	10.5

5   Analysis

Based on the data, it is obvious to see that the Gross Domestic Product of the U.S. has an upward trend which is presented in an imaginary blue line and that there are two places in the original line significantly dropping, which are i) great recession in 2008 and ii) COVID recession in 2020. I use GDP (Original) minus GDP (Trend) to get the difference. Then I divide the difference into GDP (Trend) to get cyclical of GDP. Following the same steps, the cyclical of Consumption, investment, exports, and imports sequentially come out. I've compared each with GDP through correlation. And I found out that GDP and Consumption, GDP and Investment are highly positively correlated,

GDP and Imports are correlated, GDP and Exports are slightly correlated. Since GDP and Consumption, GDP and Investment are highly positively correlated, and I separately study the ratio of GDP to each. Through analysing the chart of the Co-movement of GDP and Consumption, it obviously tells that in a short particular time span of the trendline. Consumption fits the fluctuation of line GDP. Again, analysing the chart of Co-movement of GDP and Investment, it apparently shows that in a short particular time span of the trendline. The investment fits the fluctuation of line GDP. Then through analysing the chart of the Co-movement of GDP and Consumption, it tells that in a long term of a particular time of trend, line Consumption fits the fluctuation of line GDP. Again, through analysing the chart of Co-movement of GDP and Investment, it reveals that in a long term of a particular time of the trend, line Investment fits the fluctuation of line GDP.

6   Conclusion

In this part, eventually, enough shreds of evidences are enough to draw a conclusion. In the period of depression, if it tries to restore and increase again recovering economy in a short period of time, it should stimulate investment more but also keep simultaneous Consumption and net export. Even with that being said, it is never a long way to recover from economic recession or depression. That is because of its high standard deviation ratio of GDP to Investment. Meanwhile, it can pull the GDP up in a short time to some extent, and it can fall fast with the GDP in a short time to the same extent. And if it tries to increase GDP in a sustainable way, what is needed to focus on more is Consumption, due to the data that reveals the standard deviation ratio of GDP to Consumption. This means that if it continually stimulates the growth of Consumption, it provides stable growth in the aggregate GDP, which is hard to fall dramatically during an economic recession or depression.

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