

Fiscal Policy in Public Health Crisis (COVID-19): An Analysis Based on IS-LM Model in China

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Abstract. The Chinese economy was severely impacted during the Novel Coronavirus pandemic (COVID-19). This paper will investigate the impact of the epidemic on different fields of the economy, such as consumption and investment, and the role of positive fiscal policy in the recovery of the national economy from the perspective of the government. In addition, this paper will then use the IS-LM model as the analytical method to explore the effect of fiscal policy through the movement of the curve. According to the model, in the face of the epidemic, the Chinese government has boosted economic growth through a series of fiscal policies such as increasing government subsidies, reducing taxes, and issuing consumption vouchers. Moreover, as demonstrated in the literature by different scholars, under the current condition of China, the effect of fiscal policy will be much better than that of monetary policy, and therefore it is the most effective way to address short-term shocks.

Keywords: COVID-19; China; IS-LM model; Fiscal policy.

1. Introduction

1.1. Research Background

In 2020, the Novel Coronavirus pandemic (COVID-19) swept across the world as the new severe public health emergency after SARS, threatening more than 100 countries worldwide [1]. In addition to being a serious threat to human life, the epidemic has had a significant impact on the global economy and politics. At the macroeconomic level, apart from the direct damage to affected areas, the broken supply chains caused by public emergencies can transfer risk to uninfected areas, causing substantial direct and indirect economic losses [2].

Under the situation that monetary policy could not effectively play the role in stimulating aggregate demand due to the low-interest rate environment globally, most countries considered fiscal policy as the preferred policy tool to cope with the epidemic and avoid the economy falling into a depression and introduced unprecedented fiscal stimulus policies. Faced with unexpected shocks, governments have made different fiscal policies in response to the shocks based on the circumstances of different countries. In the aftermath of the epidemic, China also quickly launched a series of fiscal policies, including the introduction of larger-scale tax and fee reductions, the establishment of a mechanism for transferring fiscal funds directly to the grass-roots level, an appropriate increase in the fiscal deficit rate, the issuance of special treasury bonds and an increase in the scale of special bonds, which have had a positive effect on stabilizing the economy [3].

1.2. Paper Organization

The structure of this paper is as follows: the first part writes the literature review, the second part establishes the appropriate theoretical model: the IS-LM curve, and the third and the fourth parts mainly analyze the impact of the epidemic on the Chinese economy and the effectiveness of the Chinese government's fiscal policy in the face of the shock. The last part of the paper indicates the limitations of the traditional IS-LM model for the analysis of the Chinese economy. In the last part of the article, the role of IS-LM Modeling in fiscal policy-making in China will be pointed out.

This paper will focus on China's real situation, comparing China's different monetary and fiscal policies before and after the epidemic to deeply investigate the impact of the epidemic on China's macroeconomy, and using the model of the traditional IS-LM curves to give the corresponding economic theory support. Through these studies, scientists can better explore the important role

played by the Chinese government's policy regulation in the economy and make more contributions to future policy research.

2. Literature Review

2.1. Research Methodology for Economic Policy during Epidemics

After SARS, the second large-scale unexpected public health crisis broke out in China in 2019: the COVID-19 pandemic. During the pandemic, several scholars used the IS-LM model to analyze the impact of fiscal policy and monetary policy on the event. In earlier studies, many scholars applied the IS-LM model to analyze the uniqueness of the model in China's political and economic circumstances. For example, Zhong (2016) used a mathematical analysis to calculate the impact of fiscal policy on national income and unemployment and derived the shape of the curve in China [4]. After that, more scholars brought China's unique model into the pandemic period for analysis based on earlier theoretical studies. Lai (2021) analyzed the impact of the pandemic on the economy from the "supply side" and "demand side" based on the classical IS-LM model, which lays the theoretical foundation for the analysis in this article [5]. At the same time, Liu (2021) also applied the model to analyze the role of macroeconomic policies on the recovery of the national economy in the post-epidemic period, which provides a broader analytical direction for this paper [6].

2.2. Impact of Fiscal Policy on the Economy

In addition to the application of model analysis, this paper also applies the method of theoretical analysis to elaborate and demonstrate the conclusions of the model as well as trigger a series of reflections on the future development of fiscal policy more comprehensively. For example, Liu (2020) focused on the influence of fiscal policy reforms in the public health and health sector on the current economy during the epidemic and formulated relatively sound guidelines and policy recommendations for the future [1]. In addition, Yang (2022) and Wei (2022) investigated the impact of proactive fiscal policy on the economy in greater depth by exploring two different aspects of fiscal policy, consumption, and tax subsidies, respectively [7, 8]. Finally, Zhang (2021) summarized the role of fiscal policy and analyzed the effectiveness of fiscal policy compared to monetary policy in China's epidemic practice, which provides more effective evidence for future research [9].

3. Set Up IS-LM Model

Fiscal policy is primarily aimed at adjusting the overall economy through changes in government expenditures (government expenditures excluding transfer payments), it functions primarily in the goods market, affecting interest rates through supply and demand, and indirectly influencing aggregate demand.

Therefore, if it is necessary to explore the impact of two different economic measures on China's overall macroeconomy during the epidemic, an IS-LM model should be developed. The model describes the Keynesian theory of aggregate demand and shows the level of output when the economy is in equilibrium due to the interaction of the money market and the goods market. The relationship between output and the market interest rate when the goods market reaches the equilibrium level of output is represented by the IS curve and the relationship between output and the market interest rate when the money market reaches the equilibrium level of output is represented by the LM curve [4]. Therefore, the IS-LM expression can be summarized as

IS: In closed economy:

$$Y = C(Y - T) + I + G \quad (1)$$

In open economy:

$$Y = C(Y - T) + I + G + NX \quad (2)$$

$$LM: \frac{M}{P} = L(r, Y) \quad (3)$$

Where Y stands for the output (real income), C stands for consumption, I stands for investment, G stands for government expenditure, T stands for government tax, NX stands for net exports, M stands for the nominal money, P stands for the price level, and r stands for the real interest rate.

From the equation above and the graphs below, it can be seen that to investigate the impact of fiscal policy on China's macroeconomy, it is necessary to determine whether the IS curve shifts as a result of exogenous factors (such as government expenditures, tax revenues, and the marginal propensity to consume, the level of investment, and so on), and, if it shifts, then it can be determined whether the impact of this policy in aggregate output is positive or not.

The IS-LM curve is now expressed in mathematical form as follows

$$IS: r = \frac{a+e+G}{d} - \frac{1-n}{d} Y \quad (4)$$

$$LM: r = \frac{k}{h} Y - \frac{1}{h} \frac{M}{P} \quad (5)$$

a denotes autonomous consumption, e denotes autonomous investment, G denotes government expenditure, n denotes marginal propensity to consume, d denotes the interest rate elasticity of investment, k is the income elasticity of the demand for money, and h is the interest rate elasticity of the demand for money.

The IS-LM model can be used to explore the impact of positive fiscal policy on the economy.

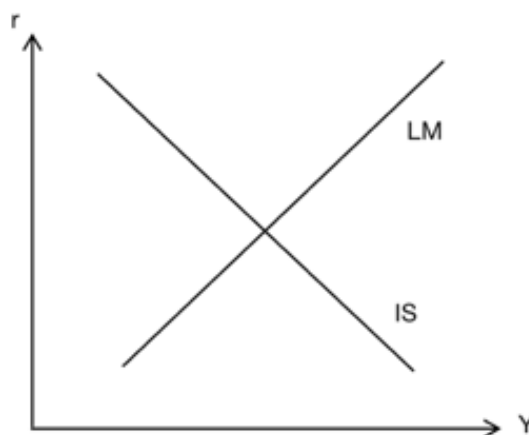


Fig 1. IS-LM Curve.

From the equation above, the impact of positive fiscal policy depends on the slope of the IS curve ($\frac{1-n}{d}$) and the LM curve ($\frac{k}{h}$) (Figure 1).

3.1. When The IS Slopes Are The Same and The LM Slopes Are Different

The slope of the LM curve depends on the income elasticity of money demand and the interest rate elasticity of money demand, the higher the income elasticity of money demand or the lower the interest rate elasticity of money demand, the greater the slope of the LM curve.

As it can be seen from Figure 2, based on the same IS slope, the flatter the LM is, the smaller the crowding out effect caused by fiscal policy. In other words, when the positive fiscal policy takes effect, it will shift the IS curve to IS_1 , which will increase the real income as well as the total output of the society. Since the demand for money will also increase, the interest rate will rise to discourage investment, therefore, as the graph shows, E_1 becomes E_2 , Y_1 becomes Y_2 . At this point, if the slope of the LM curve is smaller, it means that when the interest rate elasticity of money demand is unchanged, the income elasticity of money demand is lower, which means that the increase in real income is less sensitive to the interest rate, so the interest rate will rise to a lesser extent (as shown in Figure. 2, A), the crowding out effect is weaker, and the effect of positive fiscal policy will be more obvious.

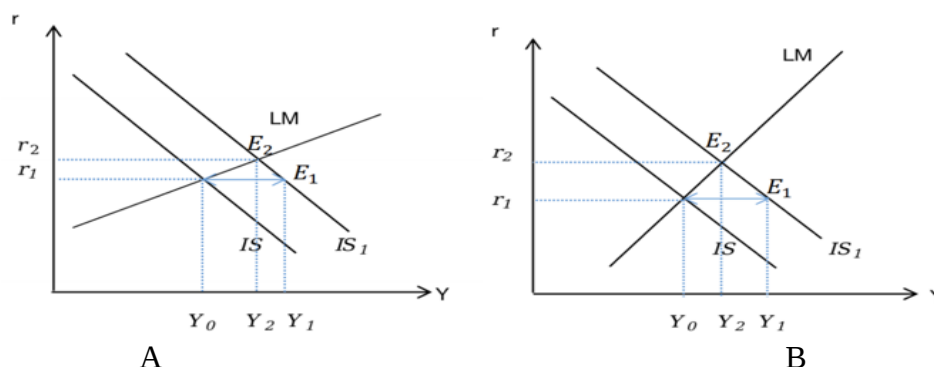


Fig 2. The Same IS Curve.

3.2. When LM Slopes Are The Same and IS Slopes Are Different

The change will be different if the slopes of LM curves are the same and the slopes of IS curves are different.

Positive fiscal policy means to shift the IS curve to the right by increasing government expenditure (G) or decreasing taxes (T) to increase real income and real output. As income is positively correlated with money demand, an increase in national income means that money demand will also increase, which leads to an increase in interest rate to discourage investment, but the crowding out effect makes the positive effect of fiscal policy partially canceled out, therefore, as the graph shows, becomes, Therefore, it can be seen from Figure 3, in the case of the same LM slope and the same marginal propensity to consume, the smaller d is, which means the smaller the elasticity of the interest rate to investment, then the larger the IS slope is and the weaker the effect of crowding-out effect is, and the more obvious is the impact of positive fiscal policy.

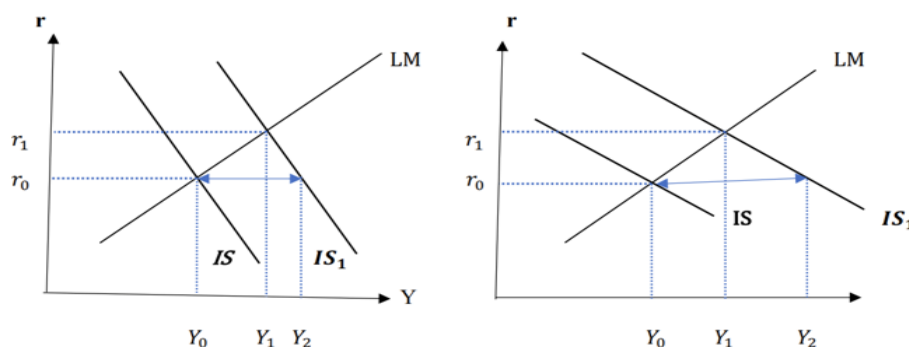


Fig 3. The Same LM Curve.

4. The Impact of the Epidemic on Chinese Economy

4.1. It caused a Major Economic Downturn and Increase Unemployment

The COVID-19 pandemic has affected the Chinese economy to a large extent. For example, according to the National Bureau of Statistics, with this external shock, in the first quarter after the outbreak of the epidemic, the Gross Domestic Product (GDP) went down for the first time. At the same time, the unemployment rate rose according to the urban survey statistics, and the job market sentiment index weakened [10]. In particular, GDP fell by 6.8% and the urban survey unemployment rate rose drastically from 5.3% to 6.2% between January and February and remained at a peak of 5.9% in March. Compared with the same period last year, the rates were 5.1 percent in January, 5.3 percent in February and 5.2 percent in March, this amount shows the biggest increase since the data was posted. After the second quarter, the COVID-19 pandemic was effectively controlled, so the economy started to increase. After the government enhanced macroeconomic control and implemented various policies for stabilizing the unemployment rate, the urban survey unemployment rate began to fall, and the employment market sentiment index bottomed out [10].

4.2. Significant Reduction in National Consumption Demand in The Short Term

The prevention and control of the pandemic needed to ban mass gatherings, so that consumer demand reduced significantly. With this shock, the country's consumer demand plummeted, and consumption and exports were significantly impacted. Simultaneously, the price level increased in the short term, and for those industries highly related to the pandemic field even suffered greater losses. As for the movie theaters, the movie box office revenue during the Spring Festival holiday in 2019 reached 5.859 billion yuan while all the movie theaters in China were closed down in 2020, resulting a zero revenue during the Spring Festival holiday [11]. As for the catering industry, with a national catering revenue of 4.67 trillion yuan in 2019, among which 15 % benefited from the Spring Festival. Therefore, the Chinese catering industry during the Spring Festival in 2020 lost about 700 billion yuan of operating income [12]. Some experts estimate that consumer income in January and February decreased by as much as 1.38 trillion yuan. As for the tourism industry, the number of tourists in the whole country reached 415 million, which achieved 513.9 billion in tourism income during the Spring Festival holiday in 2019. In 2020, however, the central government has determined that national cultural and sports activities and cross-border tourism across the provinces will not be resumed for the time being. According to statistics, except for the primary industry, which suffered a slightly smaller loss, the secondary and tertiary industries both suffered a larger loss [11].

4.3. The Investment Environment Had Deteriorated in the Short Term

The unexpected health incidents bring a huge negative impact on the world economy due to its unique urgency and uncertainty and squeeze the real economy in two ways from the demand side and the supply side. The impact on the real economy will also be transmitted to the financial market along the industrial chain, the supply chain, and the capital chain, exacerbating the difficulties of enterprise financing constraints, leading to more increase in the macroeconomic uncertainty, and falling into a vicious circle [13].

Therefore, three mechanisms will primarily affect business investment during the COVID-19 pandemic: supply shocks, demand shocks, and credit shocks. This will lead to an increase in investment uncertainty, which will result in a dramatic rise in investment risks, so expected returns have decreased, and the volume of investment in many sectors of society has declined. Some investments that needed to go through face-to-face negotiation [5].

5. The Introduction of Positive Fiscal Policy

5.1. Increase Government Spending

Fiscal policy has been active in providing financial support. By March 14, 2020, the government had spent 116.9 billion yuan on epidemic prevention and control and introduced policies such as corporate tax exemptions, deferred social security payments, and special loans. It is expected that the fiscal deficit rate will probably exceed 3 percent in 2020 [14].

By increasing government subsidies in the field of public health and providing financial support to promote research and development in public health technology, it was possible to recognize the pathogenic principles of some public health emergencies and to develop appropriate preventive and control vaccines or medicines to tackle crises. In addition, most hospitals were being encouraged to set up modest stockpiles of medical supplies, the construction costs of which would be subsidized in varying proportions by the financial sector after approved by the authorities involved [1].

In addition, various regions have increased subsidies to college graduates, especially those of Hubei nationality. Anhui province implements the “double innovation” of employment of college graduates to small and medium-sized enterprises, giving graduates a one-time employment subsidy of 3000 yuan per person, and social insurance and pre-employment skills training subsidies to enterprises by regulations [11].

This policy increased $C+I+G+NX$ by increasing G (government spending), shifting the IS curve to the right. Assuming that the LM curve remains unchanged, the new intersection point under the two curves where Y and r increase at the same time, is to promote an increase in real income and interest rates through positive fiscal policy, pulling the economy back to growth.

5.2. Increase Consumption by Issuing Consumption Vouchers

Consumption vouchers are a fiscal subsidy, with which consumers can offset a certain amount of money spent on specified goods and service providers, and this amount is borne by the government [7]. Statistics show that after the outbreak of the pandemic, local government and social funds have coordinated with others in 28 provinces and approximately 170 cities and municipalities and a total amount of more than 19 billion yuan has been distributed in consumer vouchers. [6].

Consumption vouchers can have a multiplier effect on consumption. Based on the theory of macroeconomics, the issuance of consumption vouchers increases the marginal propensity to consume of the residents, stimulates the potential shopping willingness and enthusiasm of consumers, and raises their consumption willingness and purchasing power, while the increase in consumption will, in turn, stimulate the production investment in the production sector, promote the expansion of reproduction in the enterprises, boost employment, raise the real income, and further increase the consumption [7].

Applying the IS-LM model to analyze the effects, the interpretation will be as follows. This policy is to promote the increase of consumption (C) through the multiplier effect, so that C increases, the IS curve shifts to the right, and assuming that the LM curve remains unchanged, the new intersection under the two curves at the new intersection of Y and r increases at the same time, which is also to promote the increase of real income and interest rates through positive fiscal policy, pulling the economy back to growth.

Therefore, according to statistics, consumption vouchers can be leveraged 10 times to drive online and offline consumption. In addition, the combination of consumption vouchers and Internet platforms in various regions has also boosted the growth of online retail sales [6].

5.3. Change the Taxation Policy and Reduce the Tax

In 2020, to combat the epidemic and restore the economy, the fiscal and taxation departments introduced several tax and fee reduction tax incentives, which can be divided into five sectors as the details of the emergency policy with different functions, one is for protection and rescue, another one is for the supply of materials, the following three sectors are encouragement of public welfare donations, support for the resumption of work and production, and stabilization of foreign trade and the expansion of domestic demand respectively [8].

China is also making progress in the development of tax policies to deal with health emergencies. Since the SARS outbreak in 2003, there have been more and more preferential tax policy strategies and the number of tax types involved in each preferential tax policy has increased. In addition, the regulations for each tax type have become more detailed. Compared with the past, tax exemption and deduction of donation expenses were the primary measures when facing public health emergencies, nowadays, tax incentives such as loss recovery, investment credit, and VAT tax credit are also taken into consideration [8].

Applying the IS-LM model to analyze, the tax policy is to increase disposable income Y by decreasing taxes (T), hence promoting an increase in consumption (C), which can have the effect of boosting national income and interest rates and pulling the economy back to growth.

6. The Role of IS-LM Modeling in Fiscal Policy Making in China

It is quite a controversial question about the shape of the IS-LM curve in China. In previous studies, some scholars believed that the Chinese LM curve should be downward sloping to the right. Hu (2001) argued that while the amount of the money supply in Western countries was mainly determined by

the amount of the treasury bonds that the central bank bought, the amount of money supply in China was mainly determined by the refinancing, acquisition of agricultural products, and foreign exchange behavior of the central bank. Therefore, based on his argument, an increase in the money supply in Western countries was directly related to a fall in interest rates because when the central bank bought treasury bonds at high prices, the interest rate would decrease immediately, so the LM curve sloped to the upper right. In China, on the other hand, there was no direct link between changes in the money supply and interest rate fluctuations. The increase in foreign exchange and agricultural purchases would not have led to a fall in interest rates without the special announcement posted by the central bank, so the LM curve in China should have sloped to the lower right [15].

However, this argument has proved to be unreliable now. It was too hasty to prove the relationship between money demand and interest rates as well as the slope of the LM curve in China through a single data collection without empirical analysis. According to Feng (2017), the interest rate elasticity of money demand in China was low mainly due to the huge economic gap between the rich and the poor and the imperfection of the social security system in China, so the LM curve in China should be sloped to the upper right and steeper. Therefore, the IS curve in China should be steep and slope down to the right, while the LM curve in China should also be a curve with an upward-sloping trend. Therefore, according to the analysis of the figures above, the effect of both monetary and fiscal policies will be very limited [16].

Based on Feng's view, Zhang (2021) suggested that it was mainly due to the imperfections in China's market institutions and mechanisms and the low degree of market development that when there was a recession or depression in the economy, the government should rely primarily on expansionary fiscal policy to slow down the further decline of the economy. The reason is that under the current market system conditions in China, people reacted slowly to changes in economic variables. With the transmission mechanism blocked, the effectiveness of the role played by monetary policy is greatly restricted. For instance, although the deposit and lending rates of China's commercial banks have been reduced continuously since the financial crisis in 2008, the stimulus effect on households' consumption and SMEs' investment has been very limited even though nearly 15 years have passed. Fiscal policy, however, can work quickly compared with monetary policy and have a more positive influence on public health crisis [9].

7. Conclusion

7.1. Key Findings

This paper is inspired by reading the literature of relevant scholars analyzing fiscal policy in China in response to the public health crisis in recent years. In the research process, this paper mainly takes the COVID-19 pandemic as a typical case of public health crisis, analyzes the application of the IS-LM model to the application of fiscal policy in China, and based on the model, explores the effectiveness and feasibility of fiscal policy in China's current national conditions.

7.2. Research Significance

The study can provide some policy suggestions if a public health crisis is going to happen again in the future. Based on the exploration of this paper, the following conclusions are as follows:

1. The public health crisis affects China's economy in the short term by influencing consumption behavior, investment behavior, and trade behavior.

2. Due to the imperfect market mechanism in China, the effect of monetary policy is very limited. As a result, the main strategy of the Chinese government to stimulate economic growth in the face of health emergencies is to implement positive fiscal policies.

3. There are many different fiscal policies in China to take during the pandemic, mainly by changing government spending, taxation, and consumer and investment policies to influence the national economy. During the period of health crisis, spending and investment in areas such as

healthcare is greatly increased, while industries such as tourism, food and beverage, and film are affected to a large extent.

7.3. Limitations

The IS-LM model of fiscal policy in this paper is based on the research of most scholars on China's national conditions during the epidemic period, which has not been discussed too much, so it may not be universally applicable, and may not necessarily be suitable for the current Chinese national conditions. Moreover, this paper only focuses on the effectiveness of fiscal policy and ignores the advantages and disadvantages brought by the joint implementation of monetary policy and fiscal policy, so it still has limitations.

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