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Analysis of Carbon Pricing Tools and Their Implications for the Financial Industry

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Against the backdrop of the “Carbon Neutrality” commitments, national and regional governments have to regulate carbon emissions through macro policy instruments. One of the most common approaches is to raise the carbon emissions price to guide the enterprises to gradually reduce their carbon emissions. There are two primary carbon pricing tools here: carbon tax and carbon emissions trading systems. This article aims to analyze the advantages and disadvantages of each tool, examine the potential changes of current and future carbon pricing, and explore the implications of carbon pricing for the financial industry.

I. Carbon Neutrality Commitments and Global Decarbonization Progress

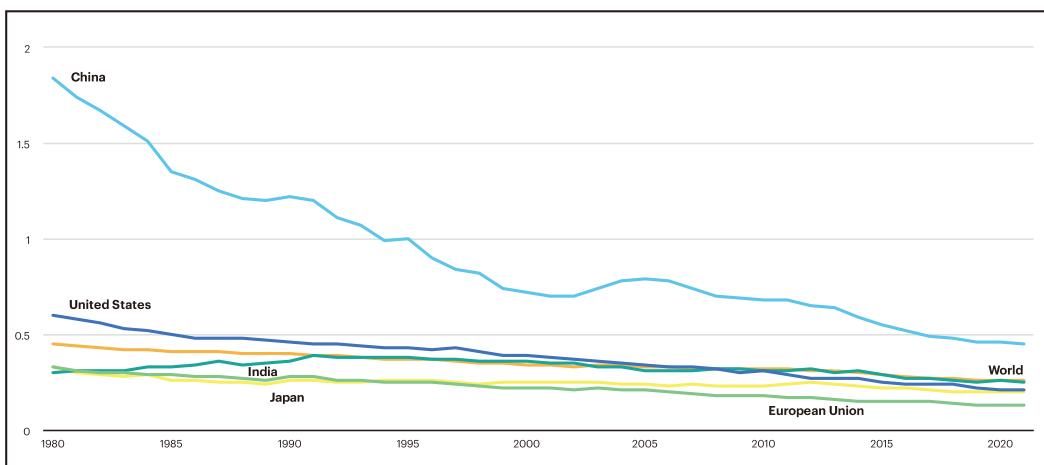
Global climate change stands as one of the most critical challenges of our time, while the transition towards a green and low-carbon economy is also recognized a new round of “green industrial revolution” following the three previous industrial revolutions in human history. The climate issue encompasses a broad spectrum of dimensions and requires the collective efforts of countries and regions worldwide to combat climate change together. The 2015 Paris Agreement, ratified by participating countries, aims to “limit the increase in global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C.” With this long-term goal, the Paris Agreement mandates governments to submit their “Nationally Determined Contributions” (NDCs)¹ every five years. In recent years, countries and regions have made commitments to achieve carbon neutrality by specific target years, striking a balance between economic growth and carbon emissions reduction.

According to data from the International Energy Agency (IEA), the global average carbon emission intensity in 2021 was around 0.26 tons of

¹ Nationally Determined Contributions (NDCs): according to Paris Agreement, each country or region is obligated to submit its target for reducing GHG emissions to the international community. These targets are required to be updated every five years, aiming to encourage the countries and regions to progressively enhance their carbon reduction ambitions.

CO₂ per thousand US dollars of GDP. While China's current carbon emission intensity is around 0.45 tons of CO₂ per thousand US dollars of GDP, higher than the other major economies, it has witnessed the largest decline in carbon intensity among these economies. This reflected China's dedicated efforts to optimize its industrial and energy structure. Due to variations in development stages and economic models, China is more reliant on coal in its energy structure compared to other major economies, and the industrial sector contributes a larger share to China's GDP. Therefore, fulfilling commitments for NDC and achieving "Carbon Neutrality" poses considerable challenges for China. Besides implementing direct fiscal measures to reduce carbon emissions, the government must adopt other effective macro policies to effectively guide market participants towards a green and low-carbon transition.

Figure 1: Carbon Emission Intensity of Major Global Economies



Sources: International Energy Agency, BOCHK Financial Research Institute Unit: tons of CO₂/US\$1,000 GDP

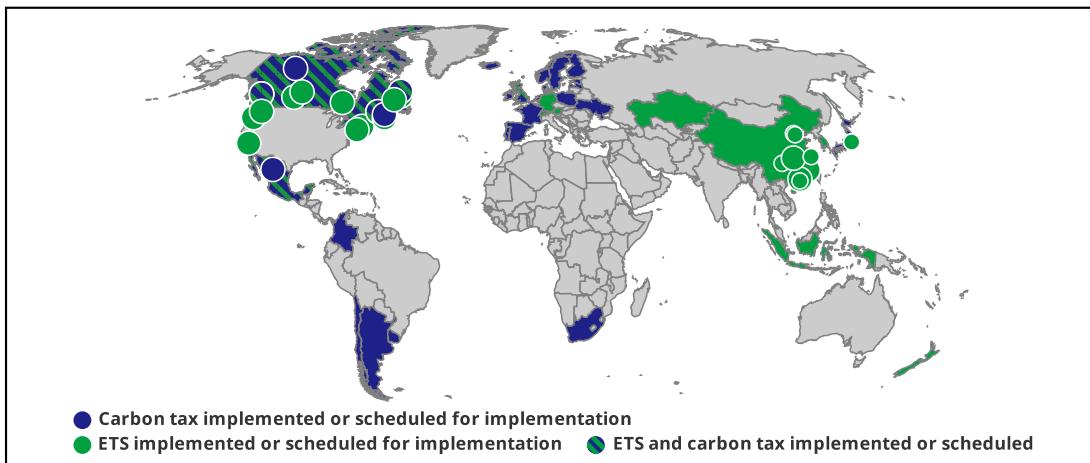
II. Analysis of Two Major Carbon Pricing Policy Tools - Carbon Tax and Emissions Trading System

National macro policies can drive carbon reduction by addressing both the "supply side" and the "demand side." On the supply side, the government can provide subsidies for the clean energy or implement tax exemptions for low-carbon technology projects. These initiatives aim to lower the cost of renewable energy generation, making it more affordable compared to traditional power sources, which will encourage more market participants to enter the renewable energy sector. On the demand side, policies can be implemented to increase the cost threshold, resulting in higher expenses for purchasing products or services with significant carbon emissions. This increase in costs aims to reduce the market demand for such goods. As a result, the concept of carbon pricing has emerged, which refers to imposing a fee for each additional ton of greenhouse gas emissions.

There is a wide array of tools available for carbon pricing, and they continue to evolve and innovate. In the private sector, leading multinational corporations such as Microsoft have pioneered the implementation of "internal carbon pricing", requiring their business units and supply chains to pay US\$15 for every ton of carbon emission generated during their daily operations or production processes. Another example is the growing trend of sustainability-linked financing. Many lending banks set greenhouse gas emissions as one of the Sustainable Performance Targets (SPTs) for their borrowers. Borrowers who have achieved the emission reduction targets are eligible to receive specific interest rate incentives.

In the public sector, the most commonly used macro carbon pricing mechanisms are Carbon Tax and Emissions Trading Systems (ETS). According to the latest information from the World Bank, there are currently 73 countries or regions worldwide implementing carbon pricing mechanisms, covering 23% of the world's total greenhouse gas (GHG) emissions. This trend indicates that carbon pricing mechanisms are becoming mainstream, and that governments at various national and regional levels are making efforts to identify the appropriate macro mechanisms to successfully achieve their carbon reduction targets.

Figure 2: Global Implementations of Carbon Tax and ETS



Sources: The World Bank, BOCHK Financial Research Institute

1. Carbon Tax and Its Advantages and Disadvantages

Carbon tax refers to a tax levied on the basis of the carbon content or carbon emissions associated with the goods or services. The underlying logic of carbon tax is to use price as a means to control quantity. By imposing a tax on high-carbon-emitting products or services in the market, it will urge the businesses to reduce the production of such goods or adopt new technologies to lower the carbon emissions associated with their products.

Carbon tax originated in the early 1990s in Nordic countries. Over the past decade, carbon tax systems have gradually gained popularity, with 36 countries or regions currently implementing carbon taxes, covering approximately 5.5% of global greenhouse gas emissions. In Asia, carbon tax has been implemented in Japan (since 2012) and Singapore (since 2019), and some Southeast Asian countries have also developed related plans. China has not yet imposed a tax specifically on carbon emissions, but it has introduced a series of environment-related taxes, such as the resource tax on crude oil, natural gas and coal, the consumption tax on refined oil products, and the environmental protection tax on air pollutants.

The implementation of carbon tax for macroeconomic regulation has three main advantages. First, levying carbon tax does not require the establishment of new market systems and rules, making it more feasible for short-term implementation. Second, the generated tax revenue can increase the fiscal income for resource redistribution, which can be used to directly support the development of green and low-carbon sectors. Third, carbon tax price is relatively stable with less volatility, providing businesses with a reliable expectation. Enterprises can use this stable carbon price to formulate future decarbonization strategies, and the financial industry can conduct climate stress testing based on the carbon tax price. However, the carbon tax system also has notable drawbacks. First, as mentioned above, carbon tax operates on a “price controls quantity” principle, leading to uncertainty in its impact on total carbon emissions and its inability to directly macroscopically control or reduce carbon emissions. Second, the fixed carbon tax price lacks the flexibility to respond to the changes of market supply and demand, resulting in a lower sensitivity for price adjustments.

2. Carbon Emissions Trading System (ETS) and Its Advantages and Disadvantages

Carbon Emission Trading System (ETS), also known as Cap and Trade Market, is the mechanism in which the market regulator sets the total annual limit of carbon emissions within the trading market, and assigns an annual carbon emission quota to each participating company. The companies that surpass or fall short of their allocated quotas can trade their carbon emission allowances within the market. The market regulator aims to achieve a yearly reduction in overall societal carbon emissions by progressively decreasing the total emissions and quotas, and the price of carbon allowance is adjusted spontaneously based on the limitation of “quantity”. This stands in contrast to the fundamental principle of carbon taxes. The carbon emissions trading system operates on the principle of “quantity controls price,” using direct control of carbon emissions to drive changes in carbon prices and guide businesses to gradually reduce their emissions under cost pressure.

Currently, there are a total of 37 countries or regions worldwide that have implemented carbon emissions trading systems, covering 18% of global greenhouse gas emissions. At present, the world’s largest ETS system in terms of greenhouse gas coverage is China’s nationwide carbon emissions trading system, and the second largest one is the European Union ETS. China’s nationwide carbon trading system was launched in July 2021 and initially included over 2,000 power companies as the first batch of participants. Despite it’s the world’s largest one in scale, its overall trading activity level remains relatively low. The European Union ETS has been in operation for nearly 20 years, covering almost all high-carbon industries such as energy, petrochemicals, iron and steel. Its carbon quota allowance policy has been progressively tightened over time, with plans to phase out of free carbon allowance in the future.

The implementation of carbon emissions trading system has three main advantages. First, it directly regulates the total amount of carbon emissions within the market, allowing for a clear and orderly reduction of carbon emissions in accordance with the predetermined targets. Second, the market mechanism is utilized to regulate the price of carbon, which can effectively respond to the market’s supply and demand condition. Third, carbon trading naturally possesses financial attributes, enabling the development of a range of carbon financial derivatives to promote the efficient and orderly resource allocation in the market. However, there are certain drawbacks associated with carbon emissions trading systems. One drawback is that the establishment of the overall carbon quota for the system often relies on subjective judgment, requiring extensive data and research to enhance the scientific nature of the target setting. In addition, carbon emissions trading systems tend to be complex and involve various stakeholders, necessitating significant human, financial, and material resources for management and operations.

3. Synergy between Carbon Tax and Emissions Trading System

Carbon tax and emissions trading system are not mutually exclusive mechanisms. Some countries and regions have adopted a parallel approach. On one hand, they leverage the market-based advantages of carbon emissions trading systems to effectively allocate carbon emission resources and achieve annual emission reduction targets through the cap-and-trade mechanism. On the other hand, they capitalize on the stability and broad coverage of carbon taxes, providing a minimum guarantee in times of low carbon trading prices. For example, France has included high carbon sectors such as energy and manufacturing in its emission trading system, while imposing carbon taxes on other industries. The UK has implemented a minimum carbon price mechanism, where carbon taxes are imposed on businesses when carbon trading prices fall below a certain threshold. This ensures that carbon emissions from businesses are still regulated even when there is

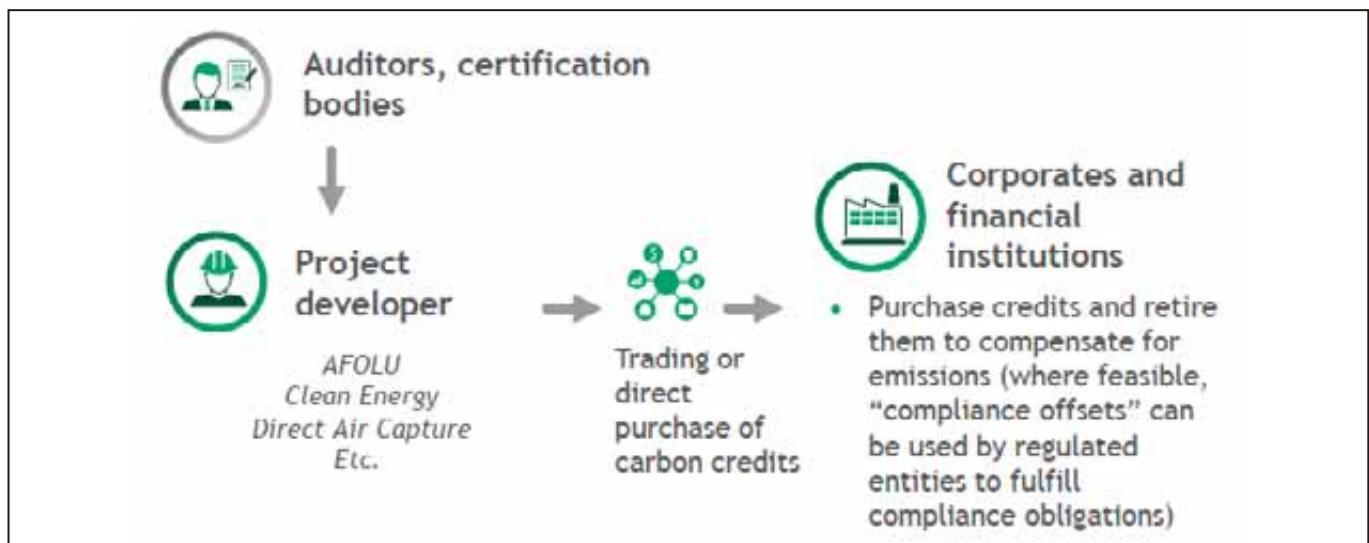
an oversupply of carbon allowances or when the trading system is not functioning well. China's nationwide carbon emissions trading system has been in operation for two years, and there have been discussions, both official and private, on the potentials of future implementation of carbon taxes by the Chinese government.

III. Voluntary Carbon Market and Its Developments in Hong Kong and Mainland China

The voluntary carbon market is another important tool for carbon pricing. It's a market-driven mechanism for the participants to trade carbon credits. In this market, buyers (usually large enterprises) can purchase carbon credits from sellers (usually environmental companies or renewable energy suppliers) with the aim to offset their own emissions and achieve their announced "carbon neutrality" goal. Each unit of carbon credit represents one ton of carbon dioxide that has been avoided or removed. For the voluntary carbon market, certification standards play a crucial role in ensuring the smooth operation of the voluntary carbon market and mitigating the risks associated with greenwashing. Some widely recognized standards include the United Nations Standard's Clean Development Mechanism (CDM), the Verified Carbon Standard (Verra), the Gold Standard (GS), and the China Certified Emission Reductions (CCER).

Core Climate, established in Hong Kong in 2022, is a voluntary carbon market that offers voluntary carbon credit products and trading tools for customers in Asia and worldwide. It is currently the only carbon market that allows settlement in both Hong Kong dollars (HKD) and Chinese yuan (RMB). Core Climate is a significant addition to the carbon market landscape in mainland China. However, Core Climate is still in its very early stage and faces challenges of oversupply of carbon credits and lack of buyers. In mainland China, the voluntary carbon emission system known as CCER has been suspended since 2017, nonetheless, the Beijing Green Exchange is currently actively exploring to restart the CCER this year.

Figure 3: Voluntary Carbon Market Mechanisms



Sources: Research report from the Green and Sustainable Finance Cross-Agency Steering Group, BOCHK Financial Research Institute

IV. Global Carbon Price and the Future Outlook

Here we have discussed the various carbon pricing tools implemented through policies and market mechanism. What is the current carbon price? According to data from the World Bank, there is a significant variation in prices for ETS and carbon taxes across different countries and regions. While in the voluntary

carbon market, where carbon credits can be freely traded, prices generally tend to be relatively consistent. The price range for a carbon credit is around US\$7.5 to US\$15.

Table 1: Overview of Carbon Prices in Major Countries and Regions Around the World

ETS	USD per Ton of CO2	Carbon Tax	USD per Ton of CO2
EU	96.3	Switzerland	130.8
Switzerland	93.8	France	48.5
UK	88.1	Canada	48.0
Canada	48.0	UK	22.3
China	8.1	Japan	2.1
Kazakhstan	1.1	Ukraine	0.8

Sources: The World Bank, BOCHK Financial Research Institute

What should be the reasonable carbon price? There are various theories in the market. For example, Bill Gates proposed the “green premium” theory, which suggested that a reasonable carbon price should reflect the price difference between clean energy and fossil fuel energy in a specific economic activity. The “green premium” is a popular theory today and it advocates for implementing carbon price to compensate for the additional cost associated with the green component. On the other hand, the International Monetary Fund (IMF) believes that countries at different levels of development should set different carbon price floors. IMF proposed a price floor of US\$75 for high-income countries, US\$50 for middle-income countries, and US\$25 for low-income countries. The theory is based on the understanding that many developed countries and regions achieved their historical development through a high-carbon emissions industrialization pathway. Therefore, these developed countries have the responsibilities and obligations to contribute more funds and assist the developing countries that are either in the process of industrialization or have yet to embark on it. The developed countries should provide financial supports to help the developing countries to bypass the high-pollution stage and directly transition to low-carbon industrialization.

Both the carbon tax and the carbon market target only impose charges on carbon emissions within their respective jurisdictions and do not extend to imported products. Therefore, in a landscape where countries and regions have varying levels of commitment to decarbonization policies and significant disparities exist in global carbon prices, some companies, in pursuit of maximizing profits, may opt to relocate their high-carbon emission industries to regions with low carbon prices, or import products with high-carbon emission as substitutes for local production. This has led to the issue known as Carbon Leakage.

To address the issue of Carbon Leakage, the European Union (EU) has recently introduced the world’s first Carbon Border Adjustment Mechanism (CBAM), or known as the “Carbon Tariff”, which imposes a carbon price on its imported products. The initial phase of implementation, spanning from 2023 to 2026, includes industries such as steel, electricity, cement, fertilizers, aluminum, and hydrogen. During this transition period, relevant companies are required to report to the authorities, and the formal collection of taxes will commence from 2026 onwards. The imposition of carbon tariffs is expected to have negative impacts on enterprises in developing countries, including China. The international community has raised controversies surrounding carbon tariffs, with arguments suggesting that it represents a new form of trade protectionism. The U.S. Clean Competition Act serves as another example of carbon tariff, following the EU’s CBAM. However, it is still in the proposal stage and has not yet been approved by the U.S. Congress. Its underlying principle is to use the average carbon emissions of U.S. products as a benchmark, and both imported products and domestic products with higher carbon emissions would be subject to carbon tax. The proposed carbon tax rate is US\$55 per ton from 2024 onwards.

What will be the future of carbon price in China? With the national commitment of “carbon neutrality”, the total carbon quota in China’s ETS is expected to decrease, leading to the rise in carbon price. According to market news, China’s ETS plans to include more industries in the future, such as cement, aluminum, iron and steel. The market volume will gradually expand, further deepening the level of marketization of carbon price. In addition, it is important to pay close attention to the progress of the carbon tariff policies in Europe and the United States, which are expected to have a certain impact on the developments of the relevant industries and the carbon price in China.

V. Implications for the Financial Industry

“Carbon Neutrality” drives the overall green and low-carbon transition of society, with financial institutions playing an important role to navigate the capital flows. In the context of the ongoing advancement and maturation of carbon pricing mechanisms, the financial industry should proactively make some necessary preparations.

1. Pay attention to the macro policy trends and make preparation in advance

The financial industry should closely monitor the policy developments of carbon pricing, such as the scope of included industries in China’s ETS and the changes in carbon prices, the progress of China’s carbon and environmental taxes, as well as the implementation of carbon tariff in Europe and the United States, etc. For clients in ESG sensitive industries, the financial industry should proactively manage climate risks and enhance their industry-specific strategies. “Carbon price” should also serve as a primary driver in climate risk stress testing models. In the future, the financial industry should adopt a forward-looking approach to monitor related macro policies and fluctuations in the carbon market’s supply and demand, and continuously improve the stress testing model and enhance its resilience in addressing climate risks.

2. Provide diversify financial instruments to actively support the development of carbon finance

At present, the both China’s ETS and Hong Kong’s Core Climate primarily focus on spot trading, and overall market activity is moderate. If we look at the EU’s ETS which has been in operation for over a decade, it’s evident that carbon trading naturally possesses financial attributes and is likely to attract a significant number of financial institutions. It is expected that there will be more carbon financial derivatives in market, such as carbon futures, carbon forwards, etc. Therefore, it is crucial for the financial industry to conduct advance research and build the necessary capacity to effectively seize carbon finance opportunities.

3. Develop decarbonization pathways and expedite the process through innovation

Many financial industries have already developed their own decarbonization or net-zero roadmap. Most of them will focus on “reducing” and “substituting” emission as initial measures, and take carbon offsetting as the last resort. As mentioned above, it is expected that carbon prices will gradually rise in the future, and many companies aligned their goals with the overall societal policy by targeting 2050 as the year for achieving carbon neutrality. Therefore, it is anticipated that carbon prices will increase at specific time points. The financial industry should integrate various future scenarios and scientifically plan its decarbonization pathways. It can consider to strategically purchase carbon credits in batches or buy “carbon futures” to lock in price in advance, and it can also explore the implementation of “internal carbon pricing” to enhance internal management. Financial institution can also consider to set up its own funds to invest in carbon offset technologies to support the low-carbon transition of society while also obtain carbon credits to offset its own carbon emissions.

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主要經濟指標 (Key Economic Indicators)

	2021	2022	2023/Q1	2023/Q2
一. 本地生產總值 GDP				
總量 (億元) GDP(\$100 Million)	28,677	28,180	7,166	7,010
升幅 (%) Change(%)	6.4	-3.5	2.9	1.5
二. 對外貿易 External Trade			2023/06	2023/01-06
外貿總值 (億元) Total trade(\$100 Million)				
總出口 Total exports	52,360	48,138	3,374	19,476
進口 Total imports	52,113	48,586	3,939	21,784
貿易差額 Trade balance	247	-448	-565	-2,308
年增長率 (%) YOY Growth(%)				
總出口 Total exports	18.7	-13.9	-11.4	-15.5
進口 Imports	17.2	-13.2	-12.3	-13.2
三. 消費物價 Consumer Price				
綜合消費物價升幅 (%) Change in Composite CPI(%)	1.6	1.9	1.9	2.0
四. 樓宇買賣 Sale & Purchase of Building Units				
合約宗數 (宗) No. of agreements	96,133	59,619	4,777	34,822
年升幅 (%) Change(%)	31.1	-38.0	-24.1	6.1
五. 勞動就業 Employment			2023/03- 2023/05	2023/04- 2023/06
失業人數 (萬人) Unemployed(ten thousands)	20.3	16.3	11.3	11.4
失業率 (%) Unemployment rate(%)	5.2	4.3	3.0	2.9
就業不足率 (%) Underemployment rate(%)	2.6	2.3	1.2	1.1
六. 零售市場 Retail Market			2023/06	2023/01-06
零售額升幅 (%) Change in value of total sales(%)	8.1	-0.9	19.6	20.7
零售量升幅 (%) Change in volume of total sales(%)	6.5	-3.4	17.5	18.9
七. 訪港遊客 Visitors				
總人數 (萬人次) arrivals (ten thousands)	9.1	60.5	274.8	1,288.4
年升幅 (%) Change(%)	-97.4	561.5	6,585.4	16,851.6
八. 金融市場 Financial Market			2023/05	2023/06
港幣匯價 (US\$100=HK\$)	779.8	780.8	783.4	780.2
H.K. Dollar Exchange Rate (US\$100 = HK\$)				
貨幣供應量升幅 (%) change in Money Supply(%)				
M1	8.0	-20.7	-19.9	-21.0
M2	4.3	1.6	1.5	1.5
M3	4.3	1.6	1.5	1.5
存款升幅 (%) Change in deposits(%)				
總存款 Total deposits	4.6	1.7	-0.9	0.5
港元存款 In HK\$	1.4	0.7	-0.7	0.2
外幣存款 In foreign currency	7.9	2.6	-1.1	0.8
放款升幅 (%) in loans & advances(%)				
總放款 Total loans & advances	3.8	-3.0	-0.6	0.0
當地放款 use in HK	4.7	-0.2	-0.2	0.7
海外放款 use outside HK	1.7	-10.0	-1.8	-2.0
最優惠貸款利率 (%) Best lending rate (%)	5.0000	5.6250	5.7500	5.7500
恒生指數 Hang Seng index	23,398	19,781	18,234	18,916